SCIENCE.

FRIDAY, MARCH 28, 1884.

COMMENT AND CRITICISM.

The University of Edinburgh is making arrangements to celebrate, on the seventeenth day of April next, the three hundredth anniversary of its foundation, by an academic assembly, to which the chief institutions of learning throughout the world are invited. Several American colleges are to be represented. With reference to this tercentenary, Sir Alexander Grant, the principal, has just published two stout octavo volumes, in which 'The story of the University of Edinburgh' is elaborately told. The volumes are rich in illustrations of all the concurrent influences which have given renown to the youngest and strongest of the Scotch institutions. The rise of each important department of instruction is told, and the lives of all the more distinguished professors are briefly given.

Among the natural sciences, medicine has been the one most encouraged in Edinburgh, although it must be remembered that much of the medical reputation of the city is due to the peculiar arrangements by which medical men not connected with the university give instruction, and prepare young men for medical graduation. 'Extra-mural' instruction is the term employed. Nevertheless, the roll of university professors includes the name of Charles Bell, of whom the story is told, that, when he visited the class-room of Roux in Paris, Roux dismissed the class, saying, 'Sufficient, gentlemen: you have seen Charles Bell.' Another university professor was Sir James Y. Simpson, whose bold introduction of chloroform as an anaesthetic is world-renowned. When a Scotchman was presented at the court of Denmark, the king said, 'You come from Edinburgh? Ah! Sir Simpson was of Edinburgh.' Simpson himself said he was more interested in having delivered a woman without pain than in having been made physician to the queen. At an earlier date the fame of William Cullen was wide-spread. Among the teachers of non-medical sciences, the names of Black, John Playfair, Robert Jameson, David Brewster, Edward Forbes, James D. Forbes, and Wyville Thomson are those which come first to mind; while in mental and moral science the Scotch philosophers, Dugald Stewart, Thomas Brown, and Sir William Hamilton, are not likely to be forgotten. It sounds strange enough in these days to read that Thomas Carlyle thought himself ill-used because he could not get the appointment of practical astronomy and astronomer royal in 1834. Instead came Thomas Henderson, who won renown as 'the first discoverer of our distance from a fixed star.' We do not name any of the living professors, and we pass without mention many famous men who are gone; but what we have said suggests the doctrine, which cannot too often be repeated in this country, that the standing of a university depends upon illustrious teachers. The world of scholars, no longer united under the sovereignty of the pope, but loyal to the higher sovereignty of truth, will with one accord extend its congratulations to the great modern foundation of Scotch learning, and will rejoice that in its three-hundredth year it has reached its greatest numerical expansion, with increasing devotion to all that is noble in science and education.

The reports of the U. S. signal-office show that there were at Cincinnati, during last February, four clear days, three fair days, one cloudy, and *twenty-one* on which rain or snow fell; and that the total precipitation was 8.87 inches. The following figures give the precipitation in inches during February of each year since 1870: 1871, 2.27; 1872, 1.67; 1873, 3.76; 1874, 5.91; 1875, 1.83; 1876, 2.92;

1877, .67; 1878, 2.33; 1879, 2.22; 1880, 4.50; 1881, 4.95; 1882, 7.04; 1883, 8.22; 1884, 8.87. We hazard nothing in asserting, that it does not lie within human ability to arrest such mighty storms as occurred in 1883 and 1884: and it may fairly be questioned whether the ingenuity of man can devise means to prevent the wide-spread and destructive floods which must follow such a volume of water as then fell; whether any extension of forests, or system of catch-basins or reservoirs, could possibly retain or mitigate to any considerable extent such general and overwhelming floods. A system of artificial lakes might indeed be at such times a serious element of danger; for, if one of them should break its restraining banks, its accumulated waters would be likely to carry away others, and then the waters, suddenly let loose, would do damage of which we have had a few frightful examples on a small scale.

THE demands of progressive agriculture for a more substantial scientific basis are just now beginning to find definite expression in the Dominion of Canada. From the known attitude of certain members of the government, from the recent examination of experts before a special House committee at Ottawa, and from the general expressions of those who have a direct interest in the question, it is apparent that a keen sense of the utility of experiment-stations is now developing a movement, which, it is to be hoped, will secure for the Dominion one or more much-needed stations, founded upon the European idea of their utility from a scientific stand-point, and from that of the practical application of acquired results.

THIS season promises to be one of unusual activity in the observation and study of tornadoes. In response to an invitation from the signal-service, a considerable number of tornado reporters is secured; and the first fruit of their labors has just appeared with most praiseworthy promptness in the form of a set of four preliminary charts illustrating the recent numerous and destructive tornadoes in the southern states on Feb. 19. Further investigation is needed before a final account of these terrible storms is prepared; but it is shown by these charts, that over fifty tracks of tornado-action have been reported for Feb. 19, between seven in the morning and midnight, all occurring within a cyclonic area, and from three to seven hundred miles south-south-east of the centre of low pressure. As the broad cyclone moved forward, its centre passing from Illinois to Lake Huron, the tornado district on its southern edge had a similar advance across the southern states. The cyclone was peculiar in showing a long, trough-like barometric depression, and in presenting notably strong contrasts of temperature between its south-eastern and north-western sides. The tornadoes were all developed within the district occupied by warm southerly winds, somewhat in advance of the cold north-westerly winds; but they moved, without exception, in a north-easterly direction. Their destructive action was most severe in eastern Alabama, northern Georgia, and centrally across the Carolinas. Rough estimates place the value of property destroyed at between three and four million dollars; the loss of life, at about one thousand; the wounded, at more than double that number; while the homeless and destitute people are reported to count from fifteen to twenty thousand, many of whom are in a starving condition. About ten thousand buildings are said to be destroyed, and domestic animals were killed in great numbers. It hardly need be urged, that the possibility of giving some warning of immediate danger before such storms warrants the fullest and most careful investigation of all their attendant conditions.

In preparation for this work, the 'tornado circulars,' issued by the signal-service to promote the accumulation of record and statistics of these destructive storms, have now reached the number of twenty. The most considerable of the later ones is No. 16, which contains, in all, two hundred and three questions or directions designed to aid in the precise description of tornadoes and the conditions of their formation: these are arranged under several head-

ings, addressed to observers on the immediate track, or more than ten miles from it; and, if carefully read, they will serve as good training for those who desire to take part in the investigation of these most disastrous upsettings of the atmosphere. Circular 18 relates to observations to be made 'concerning the presence of electricity in tornadoes,' and asks thirty-two questions to this end. It is to be hoped that all persons living in the tornado districts of the country, and desiring to take part in the work as volunteer observers, will apply to the chief signal-officer for circulars of instructions.

It is worth mentioning, that the single water-spout recorded in the supplement to the pilot-chart of the North Atlantic for March occurred on Feb. 19, eighty miles east of Charleston, where it struck the schooner Three sisters, "carrying away main gaff, mainsail and foresail, and flattening in the after-hatches." This is evidently connected with the group of tornadoes above described.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible.*

Law connecting physical constants.

IT may be of interest to some of your readers to know how the two formulae published in the advertising columns of Science, No. 54, can be derived from the magnetic theory of molecular cohesion.

The work necessary to separate completely the particles of a body occupying the unit of volume can easily be calculated if we know the original attraction between every two particles, and its rate of change during expansion. For small magnetized spheres, this work is equal to the resultant attraction across the unit of surface. The latter, moreover, is necessarily equal to the pressure which the particles keep up by their incessant motion; which, again, is shown, by a well-known dynamical theorem, to be equal to the continued product of the coefficients of expansion and of resilience and the absolute temperature. This product is therefore finally the mechanical equivalent of the internal latent heat of the unit of volume of a liquid.

The theory does not apply to such liquids as water, in which, at low temperatures, a molecular re-arrangement is evidently going on; but in general, the higher the temperature, the more closely is the law fulfilled. The grouping of the atoms, and their vibration within the molecule, recently treated by Professor Eddy of Cincinnati, produce in the most unfavorable cases a variation of about thirty per cent from the theory: nevertheless, the general agreement is too great to attribute to chance, and becomes almost perfect when the causes alluded to are considered. The average value of the latent heat for ordinary liquids may be shown to be about 1.2 times greater than for simple substances.

The molecules of all liquids appear to be very close together, notwithstanding the common prejudice that they are far apart; and, taking into account the comparative shortness of their free path, the coefficients alluded to may be obtained approximately by processes of ordinary differentiation, while their rate of change as the temperature increases can be determined as accurately as by actual observation.

The latent heat is found to vary inversely, the coefficient of expansion almost directly, as the free path of the molecule; and their continued product with the molecular weight is therefore nearly, but not quite, constant. The average value is about eight and a half; and any slight variations from this average are accounted for by the complete formula.

With these hints, and remembering that the inductive attraction between two small magnets varies as the seventh power of the distance inversely, while their normal attraction is inversely as the fourth, any mathematician familiar with the principles of physics may verify the laws already enunciated, and deduce others of equal importance in the same way.

The difference, for instance, between the specific heats in the state of liquid and vapor, is evidently the derivative of any true expression for the latent heat; and the critical temperature is found by supposing the latent heat equal to zero. The relations between all these quantities are represented with a remarkable degree of approximation.

The magnetic theory of cohesion promises to be, in molecular physics, what the law of universal gravitation has proved to be in astronomy. While carrying on the development as rapidly as possible myself, I would urge others, independently, to do the same, in the belief that this theory affords a most magnificent field, both for work and for discovery.

HAROLD WHITING.

Cambridge, March 17.

Relics in Ventura county, Cal.

Rincon Creek, fourteen miles west of San Buenaventura, is the dividing-line between Ventura and Santa Barbara counties. Where this creek flows into the ocean, at least a hundred acres are covered with shells, bones, fish-scales, and other kitchen *débris* of the Indians, who have lived here from time immemorial. The creek, which is fed by mountain springs, afforded good water; the ocean yielded fish and mollusks; while the foot-hills and mountains furnished wild game. A large variety of mollusks are still found at this point, and the shell-heaps indicate their great abundance in past time. Edible clams especially abounded; as Pachydesma crassatelloides, Tapes staminea, T. diversa, also Mytilus californianus.

Rincon Point was doubtless long a favorite resort for the early race that inhabited this coast. In one spot I found human bones, a few years since, which were in a semi-fossil state. They had been buried on the brow of a high bluff overlooking the sea, and were about four feet below the surface. One skull, that of an aged person, was perforated at the apex. The perforation seems to have been made by a sharp instrument, and some time before death, but for what purpose it is difficult to say. In another spot on the mesa, and three hundred yards from the ocean, occurred a burial-place in which the skeletons were reduced to an impalpable dust. In this dry soil and climate it must have required centuries for them to decay. In this place I found many 'sinkers' from three to twelve inches long, carved from sandstone, limestone, etc. They were from three-fourths of an

inch to an inch and a half in diameter in the middle, gradually sloping toward each end. There were also tubes of serpentine six or eight inches long, large chert knives, spear-points, and other things, all buried about four feet deep. Between this spot and the ocean was another burial-place, where, on the side of a declivity, many skeletons were found but eighteen inches to two feet below the surface, mingled with broken sandstone mortars and pestles, spear-points, arrow-heads, etc.

On the east side of the creek, between a high precipitous bluff and the ocean, is a three-cornered tract containing about ten acres, which is the site of an old rancheria or village. In the midst of this old town site I found a burial-place that indicated a somewhat more recent race than the first two mentioned. Here I exhumed a hundred or more skeletons, and at least a ton of relics: consisting of mortars and pestles of sandstone, ollas and tortilla stones of crystallized talc, pipes and bowls of serpentine, spear-points and arrow-heads of chert; also beads and 'charms,' and innumerable shell ornaments.

Last month I again visited this place, and exhumed a few more relics. In a spot about four by eight feet, and in the shape of a parallelogram, I found fifteen skeletons. With one of these were three tubes about three inches in length. In shape they were similar to the 'sinkers' already described, but with raised beads in the middle and at each end. These and some round beads were manufactured from serpentine. Beside the specimens mentioned, were many small shell disks made from Olivella biplicata. An arrow-head was found with another skeleton. About three feet from the excavation described, I found three more skeletons, one of which was that of a child; and with it occurred two stone tubes similar to those above mentioned, also three round beads about one inch in diameter. The beads and tubes were of serpentine, containing seams of chrysolite, and were finely polished. With another skeleton, were five arrow-heads finely chipped from chert. One was a beautiful specimen with serrated edges, and a portion of the asphaltum with which it was fastened into the arrow still remained. With another, occurred several ornaments manufactured from Lucapina crenulata, and also an arrow-head. In a spot occupying less than fifteen feet in diameter I exhumed forty skeletons, piled one upon another. They were buried face downward, and could be counted only by the skulls. STEPHEN BOWERS.

San Buenaventura, Cal.

The spirifers of the upper Devonian.

In the prefatory letter of the Report of progress, G. 7, of the Second geological survey of Pennsylvania, certain statements are made respecting the association and order of some of the fossil species of the Devonian rocks of New York, calling for comment.

It is stated on p. xx., in regard to Spirifera disjuncta, S. mesocostalis, and S. mesostrialis, that, "outside of Pennsylvania, these three species have been found, (1) never in any but Chemung rocks; (2) confined each to its own horizon; and (3) always in a fixed order from above downwards;" and, on p. xxi., that "Professor Hall has never seen any two of the three species co-existing in the same stratum; . . . that he cannot comprehend how S. dj. and S. ms. should be found together" (as they are reported to occur on p. 65 of the report).

Again (p. xxii.) it is stated that "Orthis tulliensis, in bed 41, § 13, p. 70, has certainly never before been seen in the Chemung 200′ above the Genesee (i.e., 300′ above the Tully limestone), nor in company of S. mesocostalis."

The report of species in such 'uncanonical' positions in the strata is made a reason for concluding (p. xxvi.) that "the startling fossil species of this report will therefore be regarded by the palaeontological reader as only *provisionally verified.*"

While the statements cited may express the general rule as to the occurrence of species in New-York state, there are specimens in Cornell university museum which do not bear out the statements.

In the first place, the two species S. mesostrialis and S. mesocostalis are found associated in the same stratum at Ithaca, N.Y., both in the mesostrialis zone and in the mesocostalis zone. Several instances can be shown where they occur on the same slab.

From a higher horizon in New-York state, and from several localities, either of these species may be found associated with S. disjuncta; and I have obtained each of the three species from the original Chemung locality at Chemung Narrows.

In the museum collection, is a small slab from that locality, containing beautiful representatives of S. disjuncta and S. mesostrialis; the latter preserving 'the fine radiate striae, with delicate concentric cross-lines' all over the surface of the shell, and with 'the broad median fold without a depression,' which are described as distinctive characters of the species (Pal. N.Y., vol. 4, p. 243).

The other specimen, only a couple of inches distant, has the characteristic plications on the median fold, and, with a surface equally well preserved, shows not the least trace of radiate or concentric striae, unmistakably indicating S. disjuncta.

From the same locality, though not on this individual slab, are specimens of both varieties of the so-called S. mesocostalis, — the large, coarse form with angular plications and reduplicated fold, and the more finely plicated form with prolonged hinge-line, which is more characteristic of a lower horizon.

These higher representatives of S. mesocostalis are, however, generally distinguished from the earlier representatives by a well-developed median septum in the ventral valve, — a character of which only a trace is seen in specimens from the Ithaca beds, reminding us of the genus Spiriferina. The punctate shell-structure of that genus has not, however, been detected in any specimens thus far examined.

In regard to Orthis tulliensis, it may be said that the common Orthis, occurring at the base of the Ithaca fauna, within a few hundred feet of the Genesee shale (less than 500), at its first appearance resembles O. tulliensis in form and general characters; though for distinction it may be appropriate to call it a variety of O. impressa, since a little higher, and in the same fauna, the typical O. impressa appears in abundance.

Still, there are specimens in the collection from the lowest zone which it would be difficult for any one to distinguish, by macroscopic or microscopic characters, from O. tulliensis, occurring, as they do, in a calcareous stratum.

I have no single slab containing this form with S. mesocostalis, but the latter is found both above and below the stratum containing the Orthis.

The record of an O. tulliensis at 200 feet above the Genesee shale in Pennsylvania seems, therefore, indicative of a careful identification of the species upon morphologic characters alone, without prejudice as to its supposed horizon or range.

In regard to the identification of these upper Devonian faunas of Columbia county, Penn., it may be said, that in the association of species, and the

relative order of the sub-faunas, the record agrees, in general, with that of the series exposed along the same meridian, farther north, in New-York state. The principal difference which strikes one familiar with the New-York section is the appearance of S. disjuncta and O. Tioga lower down in the faunas in the southern sections.

But although heretofore S. disjuncta has been met with in America only in the middle and upper parts of the upper Devonian, in Devonshire we find it reported from the middle Devonian, with corals and trilobites in abundance; and in northern Europe it begins at least as early as the base of the upper Devonian.

While it is beyond doubt that even in New-York state the three spirifers mentioned appear mingled at various zones in the upper Devonian, we do not question the fact that the periods of abundance for each species are in separate zones, and assume a regular sequence relative to each other.

HENRY S. WILLIAMS.

Cornell university.

The use of the method of limits in mathematical teaching.

Rice and Johnson's 'Method of rates' is especially to be commended for the scholarly manner in which they developed the subject; but there is the same difficulty in the fundamental conception as in the infinitesimal method. One may assume to understand an expression with which he is familiar until closely questioned. A student learns to repeat with ease, 'Velocity is rate of motion,' and thinks he understands it; but I have had many such ask, 'In a mathematically perfect engine, does the piston stop at the end of the stroke?' 'Does it remain at rest at any time?' 'How can it reverse its motion, if it does not stop?' 'How can it cease going in one direction, and move in the opposite direction, without stopping between the two motions?' These are critical questions, lying at the very foundation of all change of motion. Does change in the rate of motion take place *at* an instant, or *during* an instant?

The method of limits leads the mind towards a result the conclusions of which it is impossible to escape: hence, as a system of philosophy, it retains its strong hold.

DE VOLSON WOOD.

Hoboken, March 16.

Ropes of ice.

On Saturday, March 8, while traversing several counties of southern Ohio by railroad, I observed an illustration of the viscosity of ice, that seems deserving of mention.

For a number of hours, rain had been falling, much of it freezing as it fell; but through the day the temperature rose slightly, remaining, however, close to the freezing-point. All exposed objects were coated with ice. In particular, telegraph-wires and the strands of wire fences were heavily loaded. In the afternoon the ice broke loose from the wires at innumerable points, hanging from them in depending curves, the fixed points of which were sometimes as much as six or eight feet apart, and the lowest points of the curves from two to twelve inches below the wires. Occasionally the curves would break, and the ends of the ice rope, two or three feet in length, would project downwards from the wires at an angle of forty-five degrees or more.

The best examples were passed without opportunity to make examination, but all of the facts were illustrated at the stations where the train stopped.

E. O.

Illusive memory.

I merely intended, in my letter of March 7, to present two of the most prevalent theories which have been advanced for these illusions. The 'race memory' theory, kindly brought out by W. B. T., should perhaps have been mentioned, as well as the theory of Lewes and Ribot, that these deceptions arise from the retrojection or false location of a *present* mental image as a recollection. The inheritance of the actual *cerebral impressions* of a former generation rests upon no scientific basis. We do inherit the brain structure, and, in so far as brain functions are dependent upon structure, we may be said to inherit certain functional disposition and powers; but this structure, and the impressions made upon it by sense-perception, are essentially different facts.

The correspondence invited should be addressed to Princeton, *N.J.*, instead of Princeton, N.Y., as as wrongly given in *Science*, No. 57.

HENRY F. OSBORN.

Princeton, N.J., March 21.

Ripple-marks.

Professor Wooster's note in No. 57, on ripple-marked limestones in Kansas, recalls an observation of my own in Utah. In the south part of that territory the Jurassic formation includes a sectile limestone fifteen to twenty-five feet in thickness, containing remains of Camptonectes and Pentacrinus. Some of the surfaces of the layers exhibit coarse ripple-marks, the wave-lengths ranging from six inches to one foot. The associated fossils cannot be regarded in this case as indicative of quiet conditions, for in neighboring districts the same forms are found in argillaceous sandstones. In the sandstones the shells and crinoid segments exhibit wear from rolling, but in the limestone their angles are unimpaired. While, however, there is no evidence in the limestone of violence, there is evidence of motion. The crinoids have not been found entire, and all their segments are usually detached. Moreover, the structure of some of the limestone layers is oölitic.

I conceive that the association of ripple-marks with shallow water, while usual, is not invariable. The most important condition for the formation of ripple-marks is motion; and any thing competent to produce motion at the bottom of deep water may form them. Wind-waves on the Atlantic are said to have brought sand to the surface from a depth of five hundred feet, and they must be supposed to produce at a still greater depth the gentler agitation necessary for the formation of ripple-marks.

The association of the Kansas ripple-marks with fine argillaceous rocks is perhaps unprecedented, but there seems no theoretic reason to regard it with wonder. Fine sediment does not usually come to rest in spots where the water is subject to agitation, but exceptionally it does; and the centre of every shallow pond with a muddy bottom affords an illustration. Some years ago I observed ripple-marks on a surface of fine river-silt at the bottom of a pool which had communication with a rushing river. The pulsation of the torrent communicated agitation to the pool, but no current; and I inferred that the pulsatory agitation caused the rippling. The pool shared to some extent the muddiness of the river, and the silt on its bottom was evidently a forming deposit. Not far away the bank of the same river exhibited in section

a deposit which seemed identical with that forming in the pool, the ripple-marks being represented by undulations of the laminae. A remarkable feature of the section was the coincidence of the ripples through a vertical space of about eighteen inches. All the laminae were inflected in the same way, so that the corresponding parts of the undulations fell in the same verticals, as illustrated in fig. 1.

It occurred to me, that there might be in this feature something analogous to the assumption of stable

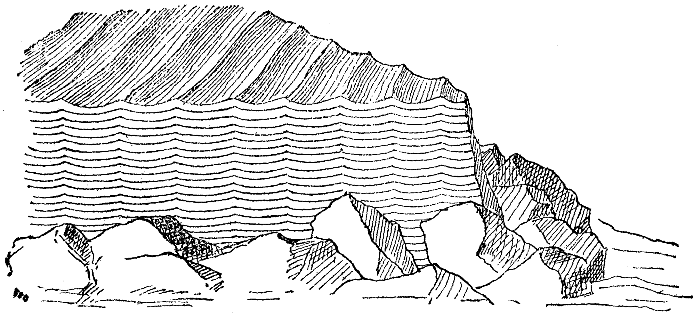


FIG. 1.

figures by free particles on the surface of a vibrating plate, and that the development of this idea might lead to a better theory of the origin of ripple-marks. The common theory, which makes the ripple-mark the homologue of the sand-dune, implies a forward movement of the ripple in the direction of the water-current, and is manifestly inapplicable to the phenomenon just described. I am disposed to doubt its applicability even to ripple-marks produced by currents; for there is a certain class of these, intimately related to small obstructions, which are certainly as stationary and constant as the water-waves on the rapid of a stream.

The analogy of ripple-marks to vibrations in elastic bodies is further illustrated by variations in the forms of the ripples, and by the combination of sets of ripples. The other figures show in profile four forms of ripple observed on upper surfaces of triassic sandstone in south-western Utah. They were carefully drawn from hand specimens. Figs. 2 and 3 are the prevalent forms. In fig. 3 the crest is acute, and the broadly curved trough is midway between the crests. In fig. 2 the crest and trough are moderately acute, and the trough is nearer to one crest than to the other. In fig. 4 the crest is broadly curved, and the trough is less so. In fig. 5 each ripple has a subsidiary crest upon one slope. The resemblance of this last to certain phonographic curves suggests itself at once. In other specimens two systems of ripples co-exist, intersecting at various angles; and the fact that this relation was observed repeatedly, leads me to think that the two sets were synchronously formed. If synchronously formed, there is something in their production analogous to the co-existence of independent and diverse vibrations in elastic bodies.

I do not venture to assert that the correspondences here pointed out are more than superficial analogies, but they suggest a line of investigation which should be fruitful. Such investigation I had intended to undertake, and the accompanying figures were engraved in pursuance of this intention; but, having found myself for some years unable to pursue the subject, I despair of commanding the necessary time and facilities, and avail myself of this opportunity to communicate my observations to the scientific public, in the hope that they may assist in the elucidation of the subject by another. G. K. GILBERT.

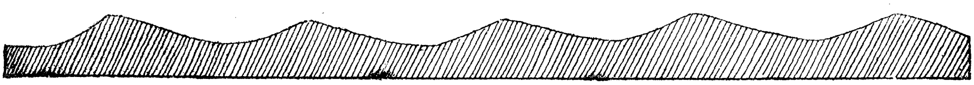


FIG. 2. — Natural size.

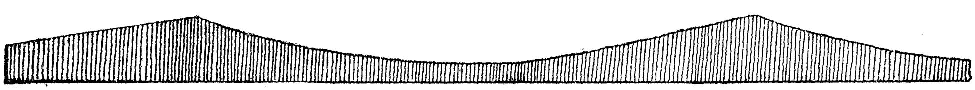


FIG. 3. — Two-thirds natural size.

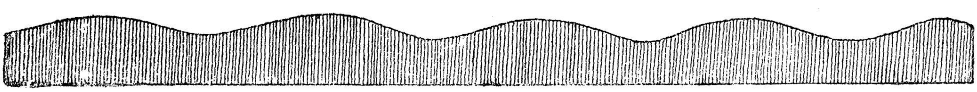


FIG. 4. — Natural size.

FIG. 5. — Natural size.

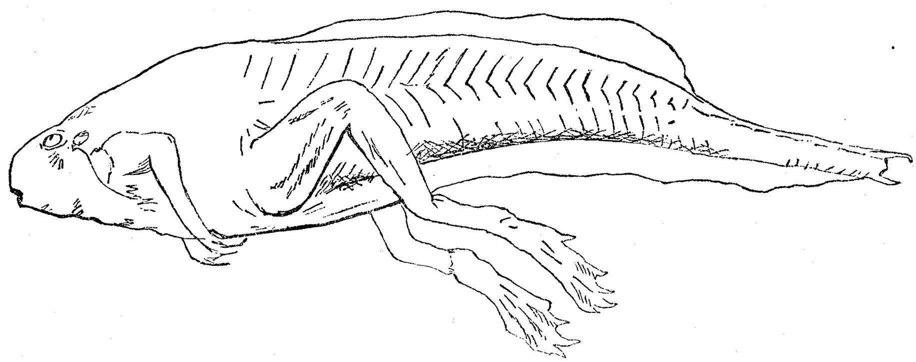
The 'Batrachichthys.'

The publication of the *Archivos do museu nacional* of Brazil began in Rio de Janeiro in 1876. In the second issue, that for the second and third trimesters of 1876, the director of the section of zoölogy and comparative anatomy in the museum published a description of what he denominated 'an extremely curious little animal called Batrachichthys' The author evidently believed he had found a 'missing link,' and, as it were, he laid his prize at the feet of Darwin, Haeckel, and Martius with the greatest solemnity.

Although the name of Prof. C. F. Hartt appears as that of one of the editors of the archivos at the time (he resigned shortly after the publication of this article), it is due his memory to say that he objected to the publication of the article referred to, and did all in his power to prevent it, well aware that it would bring ridicule upon the editors and upon the national Brazilian museum, of which he was a director. Notwithstanding Professor Hartt's protestations, the description appeared, accompanied by a plate, from which the accompanying figure is copied.

Mr. S. W. Garman afterwards called attention to the absurdity of making a new genus of this animal, which he shows to be an undeveloped form of a species of Pseudis (*American naturalist*, October, 1877).

More recently this 'extremely curious little animal' has come to the surface again, this time in the French academy. Especial attention was called, in that body, to the first volumes of the Brazilian archivos; and this description of 'a curious batrachian' was spoken of as 'a valuable essay' and 'particularly deserving attention' (*Pop. sc. monthly*, January, 1884, p. 428).



Agreeing with Professor Hartt in regard to its being nothing more than an unusual tadpole, I was anxious to obtain specimens of the animal in the various stages of its development, and thus make an ocular demonstration of the correctness of our opinions.

My work upon the Imperial geological survey, and later other duties, made it necessary for me to travel in almost every part of Brazil, and in some parts of the Argentine Republic and Paraguay; but nowhere could I find or hear of any such animal as that described in the archivos. Along the Paraguay River, which I traversed from its mouth to its source, I made especial effort to find it; for the specimen figured was said to have come from Paraguay. At length, during a trip made in 1882–83 to the interior of the province of Pernambuco in Brazil, I was so fortunate as to obtain a number of good living specimens; and it goes without saying, that they showed the Batrachichthys to be a mere tadpole. They were taken in an artificial pond near the village of Bonito, toward the end of January, 1883; being found in all stages of development from the tadpole to the full-grown frog, although the very young tadpole could not be had on account of the lateness of the season.

About Bonito these tadpoles are called *cacotes*. They are not uncommon in ditches and ponds, and sometimes occur in such numbers as to seriously interfere with fishing with the net. The full-grown frogs are called *sapos verdes* (green frogs). They are said to live in the weeds and rushes about the margins of the ponds; and, when disturbed, they jump into the water. In regard to these popular names, it should be remarked, however, that they are too general to lead one to suppose that they are applied to this species of frog alone throughout Brazil.

The specimens collected by me are now deposited with Professor Wilder at Cornell university.

JOHN C. BRANNER.

Geological survey of Pennsylvania,
Scranton, Penn.

THE GREELY SEARCH.

THE report of the board called to consider the plans of the relief expedition has been printed, and its principal features have been made public through the daily press. Two vessels have been purchased which there is every reason to believe are well suited for the work; and through the graceful courtesy and generosity of the British government, the Alert, well known as the advance ship of the Nares expedition of 1875–76, has been put at the disposition of the United States, without money and without price. A more timely and felicitous service could hardly be rendered; and the sentiment of the country in regard to it is well expressed in the communication of the 21st ultimo to congress from the president and secretary of state.

The position of affairs is about as follows: the Greely party were landed in August, 1881, at Discovery Harbor, with rations equivalent to supplies for three years on the basis used in the U. S. army; with beans, sugar, coffee, canned goods, and antiscorbutics, not embraced in the regular official ration, to the extent, as alleged, of about one year's additional provisions. Beside this, Lieut. Greely reported that about three months' supplies of fresh musk-ox meat had been killed before the departure of the returning vessel. It must be remembered, however, that the demand of human nature for food in these regions is greater than in more temperate climates; and the extra

supplies above mentioned would probably be consumed, together with the regular ration, instead of serving to extend it over a longer period. There is every reason for believing that the supply of fresh meat or game at the station is extremely precarious, accessible only during a few summer months, and perhaps practically absent in certain years. There is therefore reason to suppose that the supplies of the expedition will be entirely exhausted by the beginning of next winter.

On the failure to reach the party in 1882, it may be supposed that every care would be taken by its commander to economize supplies for the retreat last fall. This could not be carried very far; because the stamina of the men, already weakened by two years of arctic exposure, would not bear any great reduction of the ration. It is probable that Greely would have learned by the second summer, that delaying until September might prove fatal to his plan of retreat. He probably started south, if at all, in July or August, 1883. We assume that the party were living and in reasonably good health at that time.

The distance from Discovery Bay to Cape Sabine (see map) is about two hundred and fifty miles. The shore is bold and precipitous; the northern half compact, and almost without inlets or bays; and the usual ice-foot along the rocky walls of Kennedy Channel is, on this side, liable to be much broken by the grinding of floes against it. In this stretch of coast there are three caches of provisions. The first, at Carl Ritter Bay, seventy-five miles south from Lady Franklin Bay, contains two hundred and twenty-five rations, deposited by Greely himself in 1881, and sufficient to sustain his party for nine days. Sixty-two miles farther south, at Cape Collinson, are ten days' provisions, left by Nares in 1875. Fifty miles farther south, at Cape Hawkes, is a cache of unknown extent, but which Greely thought, in 1881, would subsist his party for two months. These, however, were partly in bad condition in 1881, and probably still worse in 1883.

Of the dogs taken by Greely, only eleven survived until the date of his last report, a number hardly more than sufficient to haul their own food from Lady Franklin Bay to Cape Sabine. It may be assumed that any attempt of the Greely party to retreat by means of sledges alone, would be unsuccessful and disastrous. If attempted, it probably would result in a return to their old quarters later in the season, as their only safety for the winter. Sledging over the hummocks of Kennedy Channel and Kane Basin is terrible work, and not to be compared with that done on open field-ice, like that of the sea north of Robeson Channel, or that crossed by Anjou, Wrangell, and De Long.

The practicability of a successful retreat to Cape Sabine, we believe, depended entirely upon whether the party were able to use their boats, and avail themselves occasionally of their sledges to make portages over ice isthmuses in their way. They were furnished with boats prepared especially for the purpose, besides a steam-launch, for which an abundant supply of coal might be procured from the coal strata near the station.

It is improbable, unless continuous water communication happened to favor them, that the party could transport their effects and records, together with a year's provisions for all hands. They could hardly take, in the four boats, more than eight tons besides themselves, and probably not more than six tons if any coal was carried in the launch. A year's provisions for all hands would weigh over fourteen tons. It would be necessary, therefore, for them to rely upon the stores they expected the relief-ship to cache on the east side of Grinnell Land in 1882, and upon the other caches already mentioned, to supply the deficiencies of their means of transportation.

It is highly probable, also, if the strength of the party had in any way become seriously impaired, that they would find it necessary (failing continuous land-water along the Grinnell Land coast) to abandon all but two of their boats, and as much of every thing else as they dared, to get through to the southern entrance of Kane Basin. Whether, if arrived at Cape Sabine, the caches there would suffice to pass them safely through the winter, does not seem to be certain from the rather confused statements in regard to it. It is also possible (as happened to the English on some occasions) that the condition of the ice alongshore might be such that the caches at Carl Ritter Bay or Cape Collinson, or both, might be inaccessible from the water.

We may conclude from the above facts and assumptions, that (1°) if the Greely party were able to use their boats, and reached Cape Sabine safely last fall, the probability of finding them there at open water is reasonably good; (2°) if they were not able to use their boats, they either wintered at the station (in which case they are probably in fair condition, but will be reached with difficulty, and must be reached within the year to save them), or they made an attempt to sledge southward to Cape Sabine, and can hardly have escaped serious disas-

ter; (3°) if they reached Cape Sabine, they are there at present, unless forced to attempt the transit of Smith Sound, — a task fraught with such difficulty that it may well be doubted if they could accomplish it. If accomplished, the absence of provisions expected to be found there would prove a grievous disappointment, and possibly the cause of disaster. But we think the prospect of the party, as a whole, reaching the eastern side of Smith Sound, to be almost unworthy of serious consideration, were it not that in matters like this nothing is unworthy of consideration.

The report of the board is sound and judicious, and was doubtless founded in great part upon the wise counsel of men like Nares and Schwatka, which is appended. It recommends a bounty to be offered for the recovery of the party, if north of Cape York, as urged in this journal and by various competent arctic experts among those consulted.

Since then the secretaries of the navy and war departments have united in a letter to Congress, which is too lamentably absurd to be any thing but comic. It has been well answered by Mr. George Kennan in the *New York herald* of March 19. That those poor, dear, stupid sealers and whalers might get themselves into trouble by rushing in where the navy is so much better fitted to tread, is essentially the reason offered by these landsmen as proof of the inadvisability of a reward. The common sense of mankind will put a right value on such a plea. The necessity for competent ice-navigators is sufficiently evident to any one, and is recognized by the board in its report. The necessity of leaving the ice navigation absolutely to their judgment is hinted at by Schwatka in his letter to the board, and much more fully developed by him in an interview published in the *San Francisco post* of March 1. Upon this much depends, as the experience of the Proteus in 1883 gives evidence.

The plans of the expedition are not yet fully matured, or at least not officially made public. It is stated that the Bear will sail, about April 25, to St. Johns, Newfoundland, to coal, take dogs on board, and proceed at the earliest possible moment to Disco and Upernavik, which it is hoped will be reached about the third week in May. The Thetis will follow from New York about May 1, coaling at St. Johns, and convoying a coal-steamer to Upernavik; when all three will proceed toward Cape York and Littleton Island, or Port Foulke, opening communication with the Eskimo at the earliest opportunity.

The Alert should arrive at Upernavik by June 1, and proceed during the month toward Littleton Island with the intention of providing a station to fall back upon for the crews of the two advance vessels, and later to send a sledge-party along the east coast of Smith Sound as far as the Humboldt glacier. This duty completed by Sept. 1, and the advance vessels not having been heard from, the Alert should return to St. Johns with her report.

The programme for the Alert is open to severe criticism. It cannot be too often repeated, that nearly all the chances are against any of the Greely party having reached the east side of Smith Sound, unless from Cape Isabella. The relief-vessels must follow the land-water on the Grinnell Land shore, to make northward progress. If they come to grief, they will have to retreat by that shore; and for them, as for the Greely party, a station on the Greenland side will be of no use, beside adding greatly to their perils — unless Smith Sound is navigable for small boats, which is hardly to be expected, late enough for a party wrecked north of latitude 79° 30′ to reach the Greenland side. The sledge-party along the Greenland shore will be useful only as a training in sledging for the youngsters. Here it may be observed that the report of the board contains a drawing of a new kind of sledge most ingeniously contrived to be worthless in the arctic regions. It weighs two hundred pounds, and contains bolts, bars, rivets, and varieties of metal, — enough to delight a locksmith, and, at arctic temperatures, keep him more than busy mending the breaks, and the surgeon as much so alleviating the blisters, which would rise wherever bare skin touched it.

It is understood that the expedition is to be commanded by Commander Winfield S. Schley, who will take charge of the Thetis, with Lieut. Uriel Sebree as executive officer, Lieuts. Emory Taunt and S. C. Lemlsy, Ensign Harlow, Chief-engineer Melville, and Passed assistant surgeon Green. The officers of the Bear will be Lieut. W. H. Emory (commander), Lieuts. Colwell and Reynolds, Ensign Usher, Engineer John Lowe, and Dr. Ames. The Alert will be commanded by Commander George W. Coffin, assisted by Lieut. Charles J. Badger and others not yet named. It is, of course, possible that changes in these details may occur at any time before the expedition departs. No opportunities are to be afforded for scientific observations not inevitable to the voyage — unless, perhaps, on the Alert, which returns to civilization.

That the expedition, in spite of crudities of

conception and inexperienced *personnel*, will do good work, we have no doubt; for it is the saving grace of our American navy, that its officers are apt in utilizing brief experience, fertile in expedients, and bold in execution of a task before them.

THE GREAT VIENNA TELESCOPE.[1]

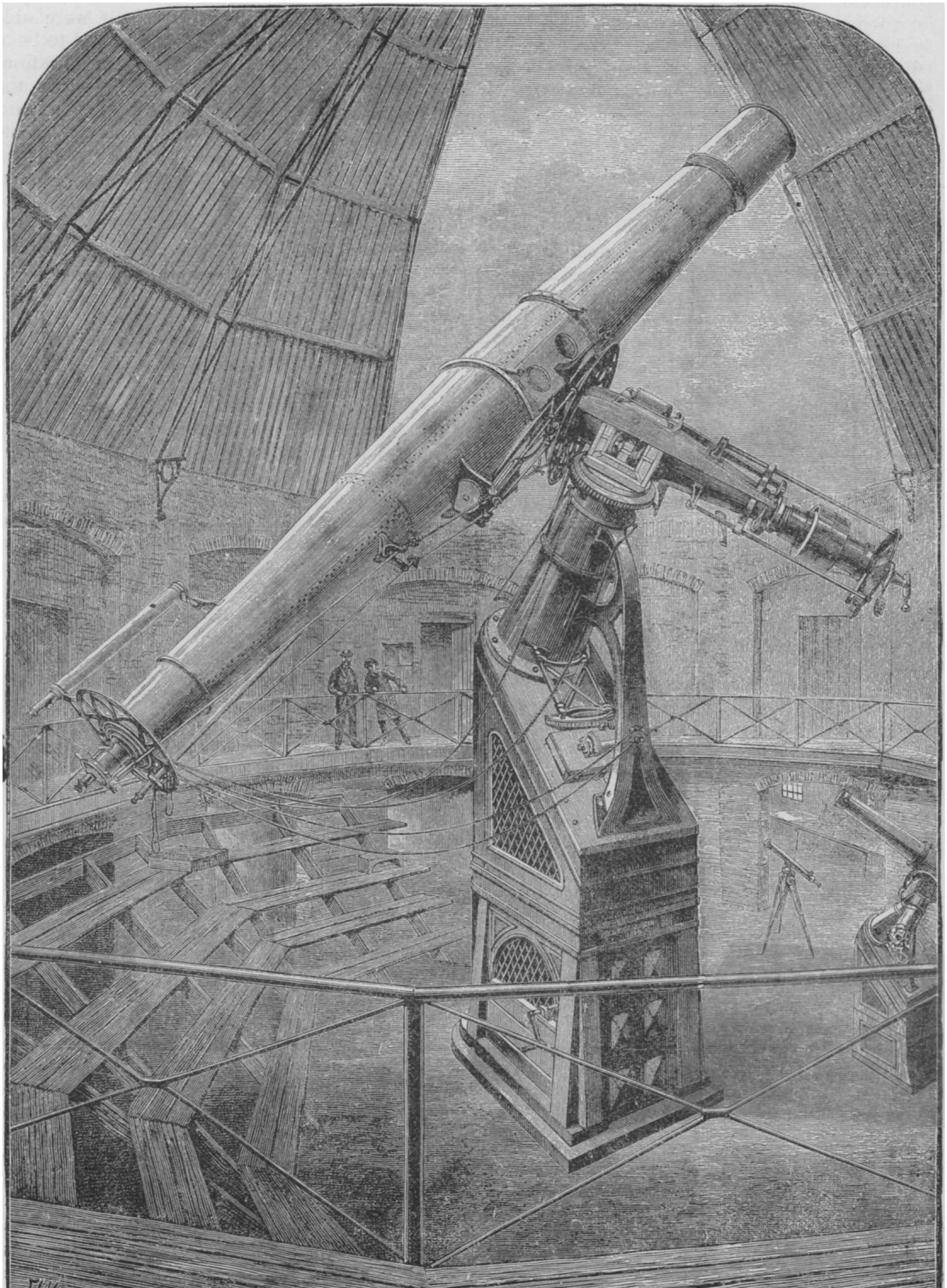
AMONG the instruments which I have examined, that to which most interest now attaches is the great telescope recently completed for the Imperial observatory at Vienna by Howard Grubb of Dublin. It is the largest refracting telescope in actual use at the present time, being of one inch greater aperture than that of the Naval observatory at Washington. The contract was made with Mr. Grubb in 1875; but, owing to difficulties in procuring glass disks of the necessary size and purity, it was not completed until 1881. Further delays occurred in mounting, so that it was scarcely ready for actual work at the time of my visit in April last. I made as critical and careful examination of its working as was possible during the unfavorable weather which prevailed at Vienna at that time. My examination was principally in the nature of a comparison of its working with that of the Washington telescope.

General character of mounting. — In its main features the telescope is mounted on the same general principle with that at Washington. Both of these instruments are counterpoised on the German plan. The tubes of both are of steel. The rapid motion in declination is by means of a rope attached to the two ends of the tube, and that in right ascension by a system of wheel-work. The clock-work is in the pier below the instrument. The leading points of difference are, that the mounting of the Vienna telescope is much larger, stronger, and heavier in all its parts; that the contrivances for making use of it are more numerous; that an elaborate system of friction-rollers in declination is provided, the Washington telescope having none; and that a more convenient system of illuminating the field and the divisions on the several circles has been adopted.

Ease of motion. — In moving the Vienna telescope, one is at first struck with the fact that mere weight is a serious drawback; but when the motion is once commenced, the movement in right ascension is almost as easy as in the Washington telescope. It is, however, very different in declination. For reasons which neither Dr. Weiss nor myself were able to perceive, the friction-rollers seemed to be of no benefit in easing the motion in declination, which was much more difficult than in the Washington telescope, and, in fact, quite a task upon the strength of the observer at the eye-piece. The quick motion for setting in right ascension is made below the end of the polar axis by turning a steel steering-wheel. This appliance is in every way inferior to the system at Washington, where the same motion is effected by an endless rope hung over a grooved wheel, which the observer turns hand over hand. By this motion the observer at the Washington telescope can make the required motion without taking his eyes from the telescope or the vernier, and without giving any thought to the motion of his hands. But the handles of the steering-wheel are much less convenient to take hold of than a rope; and, if the motion is at all rapid, the operator must be on the alert lest the steel handles strike his knuckles in the attempt to take hold of them without looking. The necessity of care in this respect makes the motion slow and laborious.

Clock-motion. — On the system of the Messrs. Clark, applied in the Washington telescope, the screw which turns the sector does not take hold of the circumference of the latter directly, but gears into a complete wheel, the axis of which is connected with the arc of the sector by a pair of brass or steel bands. By this arrangement the toothed wheel makes a nearly complete revolution while the sector is moving through its arc; and the effect of the small unavoidable irregularities in the working of the screw is diminished in the ratio of the arc of the sector to the circumference of the wheel. Whatever advantages this arrangement may have in small instruments, I think that in large ones they are more than counterbalanced by the evils arising from the elasticity of the band, combined with the changes of friction, the action of the wind, and other forces acting to vary the uniform motion of the telescope. Owing to this elasticity, the effect of the wind or of any slight pressure by the observer on the eye-piece is many times greater in the Washington than in the Vienna instrument. But it did not appear to me that the firmness of the connection in the latter instrument between the support of the turning-screw and the tube of the telescope was as great as supposed by those who lay stress on large and stable mountings. I found that, by a simple pressure of the thumb-nail upon the eye-piece of the

[1] Extract from a report to the secretary of the navy on recent improvements in astronomical instruments, by SIMON NEWCOMB.



Vienna telescope, the pointing in right ascension could be changed by a number of seconds, so as to throw an object entirely away from the wire. The main question is, however, the steadiness of motion when no pressure whatever is applied by the observer or the wind; and, so far, I have found no large telescope which is entirely satisfactory. The Vienna telescope was not supplied with a micrometer at the time of my examination, so that I could not test its motion as thoroughly as I wished to; but, by bringing the planet Uranus in the edge of the field, I found that there was constantly an irregular movement in right ascension, the amount of which I estimated as between one and two seconds of arc. This movement had no regular period, and therefore did not seem to be connected with any defect in the figure or motion of the screw. Its irregular period, if I may use the term, varied from the smallest appreciable amount to two or three seconds of time. Its most probable cause seemed to be the irregular friction of the motion in right ascension, and especially of the friction-rollers, by which the polar axis is supported at its lower end. A similar irregularity is noticed in the Washington telescope; but I think it is decidedly less than in the Vienna one, provided that no strong wind is blowing on the instrument.

Arrangement of sector. — In Mr. Grubb's large telescope an attempt is made to give greater stability to the screw by having its axis immovably fixed to supports in the massive base of the telescope, which renders it incapable of any motion except that of turning. The screw cannot, therefore, be unlocked from the sector, as in the instruments by other makers. When the sector reaches the end of its motion, it is to be turned back by giving a rapid backward motion to the screw itself, for which special apparatus is provided. From what I have already said, I am of opinion that this arrangement offers no advantage to compensate for the trouble which it causes the observer.

Slow motion. — The slow motion in right ascension in the Vienna telescope is endless, instead of being confined between narrow limits, as in that at Washington. This is a decided improvement, saving the observer much loss of time from the motion running out.

Illumination. — The apparatus for illuminating the field of the micrometer was not in perfect order at the time of my visit, so that I need not report upon it in this connection. It is in its general character similar to the system adopted by the Messrs. Repsold, of which I shall speak hereafter. The illumination of the divisions of both circles leaves nothing to be desired.

Minor points. — In the preceding I have indicated what may be considered fundamental points affecting the use of the instrument. There are, however, several minor points which are of almost equal importance, so far as the practical use of the instrument is concerned. As the instrument now stands, the drawback which strikes me most was the absence of any rough setting, either in right ascension or declination, and the impossibility of seeing, even approximately, the pointing in declination, except when the observer is at the eye-piece. This, when combined with the great force necessary to move the telescope in declination, makes its pointing a difficult and troublesome operation. The observer must first set the telescope by pure guess-work. He has then to mount to the eye-piece, wherever it may be, look into the microscope, and note the reading of the circle. He has then to withdraw his eye, and, by considerable muscular exertion, to make another guess, which he can test by again reading the circle. Thus the pointing is to be made by a series of trials, which are so troublesome that I found the observers were in the habit of mounting to the top of the clyinder in the dome, and finding the pointing in declination by moving the telescope around the horizon.

I remark, in this connection, that the Washington telescope has a coarse setting, which the observer can read from any point below the telescope with the aid of an opera-glass.

Objective. — The proper figuring of a great objective so as to give the best possible image of a celestial object is justly considered the most difficult task in the construction of a large telescope: especial interest, therefore, attaches to Mr. Grubb's success with the objective. The atmospheric conditions were very unfavorable to the finest tests, but I succeeded in making such examination as the circumstances admitted on three evenings. On the first trial the image was found to be distorted, owing to want of adjustment of the glass itself. This was soon corrected by Director Weiss. On the second trial I found a well-marked spherical aberration, which seemed, however, to be very regular from centre to circumference. But there had been a fall of temperature, and the dome had been opened but a short time, — circumstances under which the Washington telescope always exhibited the same phenomenon. On the third evening the dome had been opened long enough to nearly equalize

the temperatures. So far as I could judge, the character of the image was perfect, there being no appearance of those rings of different focal lengths which are commonly seen in large objectives. As I had not used a large telescope for some eight years, I could not feel that my judgment was an entirely critical one; but I am persuaded, that, if any defects exist, they are so minute as not to interfere in the slightest with the finest performance of the instrument.

I have been led by the examination above described, combined with some experience in the use of the Washington telescope, to some conclusions respecting the most appropriate features in the mounting of an instrument of the largest size. They may here be enumerated for the consideration of those engaged in constructions of this kind.

1. I think, that, in order to secure the necessary stiffness with the least weight, the axes should be hollow. The material can then be made comparatively thin. It is true that the greater the friction, the larger the axis; but the mass of metal in the interior of the axis contributes so little to its stiffness that the external diameter will have to be increased very little to secure the same stiffness with the hollow axis as with the solid one.

2. It is not worth while to supply the declination-axis with friction-rollers, unless experiment and research shall show that they can be made more effective than they appear to be in the Vienna instrument.

3. The best quick motion in right ascension is that adopted in the Washington telescope, where the observer pulls an endless rope hand over hand, and can lock and unlock at pleasure the gearing which connects the turning-wheel with the telescope.

4. If, as is probable, the quick motion in declination by means of the loose rope attached to the two ends of the telescope requires too strong a pull, the best method of giving this motion is through a gearing turned by an axis passing centrally through the polar axis, on the Repsold plan; but it is desirable to have this motion made by turning a crank, or pulling a rope, rather than by taking hold of the wheel.

5. Coarse divided wheels should be supplied, so that the observer, while turning the instrument, can constantly see its approximate pointing. It is better if this coarse reading can be made with the naked eye, as is the case with the right-ascension movement in Washington. The declination-circle, being farther from the observer, has to be read with an opera-glass if more than a coarse fraction of a degree is required. By such an arrangement the telescope can always be set by the quick motion so nearly that any object sought shall be in the field of view of the finder. In nine cases out of ten this will be all that is required in practical use. It should never be forgotten that in all quick motions it is very desirable that the observer should be able to keep his eye upon the movements of the telescope itself, so to save him from even a groundless apprehension that something may be going wrong.

6. The slow motion should, if possible, be endless. There is no difficulty in making it so in right ascension: there may be, however, in declination.

7. When the instrument is so large that there is an interval of three feet or more between the centre of the polar axis and the side of the tube, the screw which communicates the clock-movement should be geared into a complete circle rather than into a sector. The use of a metal band to multiply the intervening radius of the wheel offers no advantage, in the case of large instruments, to compensate for the disadvantage of want of stability arising from elasticity of the band and its fastenings.

8. In this connection the question arises of applying the Greenwich system, which consists in setting the hour-wheel so that its position shall correspond to sidereal time, and clamping to it a second wheel corresponding to right ascension. Every practised astronomer is familiar with the trouble in setting an ordinary equatorial, arising from the necessity of having to calculate the constantly varying hour-angle of the object on which he points. With the Greenwich arrangement there is no such trouble. The worm-wheel being once set to sidereal time, the observer has only to set the other one to the constant right ascension of the object. It is true that practical difficulties arise in the usual construction, owing to the fact that the vernier on the gear-wheel will from time to time be on every point of the circle; but this difficulty can, I think, be obviated by appropriate arrangements.

9. A clock-motion which can be kept up by water or other power is greatly preferable to any system which requires an assistant to wind up a weight.

10. The entire practicability of illuminating the divisions of the circle by lamps, and of reading these divisions from the eye-end of the telescope, has been so completely demonstrated, that all large instruments should be supplied with this arrangement.

11. The system of illuminating wires, field-micrometer slit, etc., by a single lamp which

shall be vertical in all positions, has been so perfected by the Repsolds, that it leaves nothing to be desired.

12. The Washington plan of having the whole micrometer-plate, including both fixed and movable wires, moved by a fine screw, offers such a convenience in setting, that it should always be adopted.

13. The old system of having a single finder on that side of the telescope which is opposite the declination-axis becomes very inconvenient in a large instrument, owing to the necessity of setting the slit in the dome, not only to the telescope, but to the finder. The plan adopted in the Vienna telescope, of having two finders, — of which one shall be above, and the other below, the telescope when the latter is in the meridian, — obviates this difficulty, and should always be adopted.

THE AMERICAN AWARDS OF THE GEOLOGICAL SOCIETY OF LONDON.

We give below the text of the addresses on the occasion of the awards to Dr. Leidy and Mr. Lesquereux at the annual meeting of the Geological society of London in the middle of last month.

The president handed the Lyell medal to Prof. W. H. Flower, F.R.S., for transmission to Dr. Joseph Leidy, F.M.G.S., and addressed him as follows: —

Professor Flower, — The council has bestowed on Dr. J. Leidy the Lyell medal, with a sum of twenty-five pounds, in recognition of his valuable contributions to paleontology, especially as regards his investigations on the fossil Mammalia of Nebraska, and the Sauria of the United States of America. These vast, and, in comparison with our own country, but little explored, territories have for some years past yielded a harvest of fossil vertebrate remains of exceeding richness, of which we have no example here. How well this harvest is being garnered by our trans-Atlantic *confrères* the flood of memoirs published by them during the last quarter of a century bears witness. Amongst these scientific laborers in the paleontological harvest-field, Dr. J. Leidy has held a foremost place. Careful in observing, accurate in recording, cautious in inferring, his work has the high merit which trustworthiness always imparts. The well-nigh astounding number of papers written by him between 1845 and 1873 (amounting to a hundred and eighty-seven), his reports on the 'Extinct vertebrate fauna of the western territories,' his 'Synopsis of the extinct Mammalia of North America,' and his 'Cretaceous reptiles of the United States,' testify to the fertility of his pen.

Professor Flower, in reply, said: — Mr. President, as I have profited so deeply by Dr. Leidy's paleontological writings, and also have the pleasure of his personal friendship, I was much gratified by his request, communicated to me by telegraph a few days ago, that I would represent him on this occasion, and receive from your hands the award which the council has so worthily bestowed. By the same means of communication, he mentions the interesting incident, that it was by Sir Charles Lyell's advice, given to him in Philadelphia about thirty years ago, that he was induced to abandon the study of medicine and take up paleontology. A letter which I understand Dr. Leidy has written, in which he doubtless has expressed his own thanks to you, has not yet reached me; but I am quite sure that this recognition of his valuable labors in that marvellously fruitful field of discovery, the extinct vertebrate fauna of North America, will be greatly appreciated by him and by his fellow-countrymen, by whom he is so justly esteemed.

The following is the letter from Dr. Leidy, mentioned by Professor Flower: —

Philadelphia, Penn., 1302 Filbert Street,
Feb. 7, 1884.

My dear sir, — I have just this minute received your note of Jan. 25, and hasten to reply, that there may be no delay in my answer, for the anniversary meeting of Feb. 15. I was equally surprised and delighted at the action of the council of the Geological society in awarding to me the Lyell medal and its accompaniment. Such approbation of my services I regard as rich compensation, added to the pleasure derived from my labors. I must add that I feel as if Sir Charles Lyell himself was expressing satisfaction, in consideration of my having complied with his wish, when thirty years ago, in my own home here, he said he hoped I would devote my time to paleontology instead of medicine.

Please present to the Geological society my warmest thanks for the honor it has conferred upon me. I have written to Prof. W. H. Flower, asking him to receive the award on my account.

With sincere regard,
Joseph Leidy.

Mr. Warington W. Smyth,
For. sec. Geol. soc.

In handing to Professor Seeley, F.R.S., a second portion of the proceeds of the Barlow-Jameson fund for transmission to Professor Leo Lesquereux, F.C.G.S., the president spoke as follows: —

Professor Seeley, — The council has awarded to Professor Leo Lesquereux the sum of twenty pounds from the proceeds of the Barlow-Jameson fund, in recognition of the value of his researches into the paleobotany of North America, and to aid him in further investigations of a similar kind. Professor Lesquereux's 'Contributions to the fossil cretaceous and tertiary flora of the western territories,' published in the 'Reports of the U. S. geological survey,' are works which, for their matter, typography, and illustrations, leave nothing to desire. In transmitting this award to Professor Lesquereux, you will convey to him the hopes of the council that it may assist him in prosecuting further investigations in the difficult branch of research in which he has already accomplished so much.

Professor Seeley, in reply, said: — Mr. President, I

feel much honored in receiving this award on behalf of Professor Lesquereux. His valuable researches not only contribute systematic descriptions of the American secondary and tertiary floras, but furnish almost the only data for comparing those floras with the plant-life from similar strata on this side of the Atlantic. All Professor Lesquereux's work is marked by such exactness and care, that I am glad we are thus able to honor it, and offer assistance in its progress.

THE DIFFICULTY OF PREVENTING THE OHIO FLOODS.

WILLIAM E. MERRILL, lieutenant-colonel U. S. engineers, in charge of the government improvements in the Ohio River, has, at the request of the editor of the *Cincinnati commercial gazette*, made public his views respecting the causes of the Ohio floods, and discussed the possibility of their mitigation in a letter published in the issue of March 8 of that journal.

In attempting to estimate the influence of forests, he says, experience has proved that the clearing and cultivation of level land have comparatively small effect upon floods, and may be left out of account: disastrous effects follow only when the hill and mountain sides are put under cultivation. The evil results of denuding the hills of trees are then illustrated by references to Spain, Palestine, Greece, parts of Italy and France, and the good results of reforesting the slopes of the French Alps noted.

Above Cincinnati the watershed drained by the Ohio comprises the western third of Pennsylvania, the whole state of West Virginia excepting four counties, the eastern part of Kentucky, and nearly the entire state of Ohio. Now, leaving out of consideration the more level portions of this area, the question is, whether its hilly and mountainous parts have been cleared of forests to such an extent as to materially affect its capacity to retain the rainfall, and so to call for legislative action to prevent greater calamities in the future. Col. Merrill answers this question emphatically in the negative. Speaking from an extended personal knowledge of the states of Pennsylvania, West Virginia, and Kentucky, which comprise the hilly portion of the Ohio basin, he says we are very far from having attained that state of forest destruction which would require the intervention of the government for the protection of the river-valleys in this manner. Any one who travels on the railroads which cross the Alleghanies sees that the country is still heavily wooded, while away from the lines of the railroad it is still a wilderness, except in a few isolated valleys. Even the removal of the merchantable timber from the country would do no especial damage, provided the underbrush and smaller trees were left to protect the soil. We thus far have no sure ground, he remarks, for asserting that man's interference has had any marked influence upon the discharge of the Ohio.

In sharp contrast with these views of Col. Merrill is an article on forests and floods in the *New York independent* for March 6 (p. 30), by Mr. N. H. Egleston of Washington, D.C., in which the basis of argument seems to be furnished by the map prepared by Professor Sargent to illustrate the census returns in regard to the condition of the forests, and more particularly by a careful examination of the amount of woodland now existing in the state of Ohio as compared with that of twenty years ago.

As the state is not much of it hilly, the argument appears in so far to be inconclusive, although the author states and explains the popularly accepted theory of the controlling influence of forests with great skill, and without hesitation ascribes the Ohio floods to their destruction. But Col. Merrill very pertinently remarks that the traditions of the aborigines show that even the great flood of 1884 was equalled by floods which occurred before white man's axe felled a single tree in the valley of the Ohio.

Whatever may be thought of the relative value of opinion upon this question, there is no doubt that Col. Merrill speaks as an expert and an authority when he treats the problem of controlling the surplus waters of the Ohio by artificial means. He says, the idea that it is possible to build a number of reservoirs in the mountains to store up water during freshets, and let it out during the scarcity of summer, is an old one, and one which has been discussed and abandoned in case of various European rivers. It was, moreover, advocated by the able engineer, Charles Ellet, jun., and vigorously pressed upon the attention of Congress. When the improvement of the Ohio was taken in hand by the government, after the close of the civil war, this scheme was practically investigated by W. Milnor Roberts, whose long engineering experience in railroad and canal construction in western Pennsylvania, and consequent familiarity with its topography, peculiarly fitted him for this work. After an exhaustive examination of possible sites, and estimate of cost of retaining reservoirs, which will be found in detail in his report to the chief of engineers under the date of April 30, 1870, he concludes thus: "My own careful investigations of the subject of controlling the floods of the Ohio by means of artificial reservoirs, which were made in 1857, satisfied my mind conclusively that such control by human means, attainable within practicable limits of cost, is impossible."

Mr. Roberts then examined another question, which was the practicability, not of controlling the floods at all, but of simply storing sufficient water to provide a supply to supplement the scarcity of the summer to such an extent that the summer flow at Wheeling should not fall below six feet. The reservoirs required to accomplish this were estimated to have a capacity of not less then a hundred and fifty billion cubic feet, and they must store the drainage from a watershed of not less than thirty-six hundred square miles. The estimated cost of accomplishing this with thirty reservoirs was sixty million dollars, a sum out of all proportion to the advantage to be derived from the improvement. Moreover, the dangers attendant upon such reservoirs are too great to justify the construction of even the few reservoirs required to secure a navigable stage of water, to say nothing

of the vastly greater constructions which would be needed in any attempt to control floods. There is special insecurity necessarily inhering in the foundations of hydraulic work such as this, constructed in the bed and banks of running streams. Besides this, mention may be made of the interference which such reservoirs would cause in vested interests, such as mills, factories, railroads, canals, and rafting.

The latter portion of Col. Merrill's letter advises the city of Cincinnati to appoint a commission to define the lines of the river-front for high and low water, and to make it the duty of some public officer to prosecute in case of infringement on the free waterway, so that there may be no future obstruction of the river-channel. He shows that to the present time there has been no perceptible obstruction at this point. He further advises that the lower part of the city, next to the river, be filled by continuing the present slope of the river-banks upward to high-water mark; and then that those squares of the city which stand on the slope be devoted to business alone, and be so solidly built as not to be seriously damaged by an occasional flood, while the houses of the laboring population be removed to other parts of the city.

In conclusion, Col. Merrill says, in reply to the question which has frequently been put to him as to what the government is going to do to try to stop these floods, that, if the government be guided by his advice in this matter, it will do nothing, as the undoubted cause of the flood was the excessive fall of rain and snow; and no means of controlling this has yet been discovered.

AN EXPLANATION OF HALL'S PHENOMENON.[1]

MR. E. H. HALL's original experiment was as follows. A strip of gold-leaf was cemented to a plate of glass, and placed between the poles of an electro-magnet, the plane of the glass being perpendicular to the magnetic lines of force. The current derived from a Bunsen cell was passed longitudinally through the gold; and, before the electro-magnet was excited, two equipotential points were found by trial near opposite edges of the gold-leaf, and about midway between the ends. When these points were connected with a galvanometer, there was, of course, no deflection. A current from a powerful battery being passed through the coils of the magnet, it was found that a galvanometer-deflection occurred, indicating a difference of potential between the two points, the direction of the current across the gold-leaf being opposite to that in which the gold-leaf itself would have moved across the lines of force, had it been free to do so. On reversing the polarity of the magnet, the direction of the transverse electromotive force was reversed; and, when the magnet was demagnetized, the two points reverted to their original equipotential condition. Subsequent experiments showed that the direction of the effect differed according to the metal used. This effect was attributed by Mr. Hall to the direct action of the magnet on the current.

Mr. Bidwell claims that Hall's phenomenon might be completely explained by the joint action of mechanical strain and certain thermo-electric effects. The strain is produced by electro-magnetic action. It will be convenient to refer to the metallic plate or strip as if it were an ordinary map, the two shorter sides being called respectively west and east, and the two longer, north and south. Let the south pole of an electro-magnet be supposed to be beneath the strip, and let the strip be traversed by a current passing through it in a direction from west to east: then the strip will tend to move across the lines of force in the direction from south to north. Since, however, it is not free to move bodily from its position, it will be strained; and the nature of the strain will be somewhat similar to that undergone by a horizontal beam of wood which is rigidly fixed at its two ends, and supports a weight at the middle. Imagine the strip to be divided into two equal parts by a straight line joining the middle points of the west and east sides: then in the upper or northern division the middle district will be stretched, and the eastern and western districts will be compressed; while in the lower division the middle part will be compressed, and the two ends will be stretched. If, now, a current is passing through the plate from west to east, the portion of the current which traverses the northern division will cross first from a district which is compressed to one which is stretched, and then from a district which is stretched to one which is compressed; while in the southern division the converse will be the case. And here the thermo-electric effects above referred to come into play.

Sir William Thomson, in 1856, announced the fact that a stretched copper wire is thermo-electrically positive to an unstretched wire of the same metal, while a stretched iron wire is negative to an unstretched iron wire. From this it might be inferred, as Sir William Thomson remarks, that a free copper wire is positive to a longitudinally compressed copper wire, and that a free iron wire is negative to a longitudinally compressed iron wire; and experiment shows this to be the case. *A fortiori*, therefore, a stretched copper wire is thermo-electrically positive to a compressed copper wire, and a stretched iron wire is negative to a compressed iron wire. If, therefore, a current is passed from a stretched portion of a wire to a compressed portion, heat will (according to the laws of the Peltier effect) be absorbed at the junction if the metal is copper, and will be developed at the junction if the metal is iron. In passing from compressed to stretched portions, the converse effects will occur.

It follows from the above considerations, that, if the metal plate (which is subjected to a stress from south to north, and is traversed by a current from west to east) be of copper, heat will be developed in the western half of the northern division, and absorbed in the eastern half; while heat will be absorbed in the western half of the southern division, and developed in the eastern half. But the resistance of a metal increases

[1] Abstract of a paper read at the meeting of the Royal society, Feb. 21, 1884, by SHELFORD BIDWELL, M.A., LL.B.

with its temperature. The resistance of the north-western and south-eastern districts of the plate will therefore be greater, and that of the north-eastern and south-western districts smaller, than before it was subjected to the stress; and an equipotential line through the centre of the plate, which would originally have been parallel to the west and east sides, will now be inclined to them, being apparently rotated in a counter-clockwise direction.

If the plate were of iron instead of copper, the Peltier effects would clearly be reversed, and the equipotential line would be rotated in the opposite direction.

The peculiar thermo-electric effects of copper and iron, discovered by Thomson, are thus seen to be sufficient to account for Hall's phenomenon in the case of those metals. It became exceedingly interesting to ascertain whether the above explanation admitted of general application; and the author therefore proceeded to repeat Thomson's experiments upon all the metals mentioned by Hall. The results are given in the following table, where those metals which in Hall's experiments behave like gold are distinguished as negative, and those which behave like iron as positive.

Metals.	Forms used.	Direction of current.	Hall's effect.
Copper	Wire and foil, pure.	S. to U.	Negative.
Iron	Wire and sheet, annealed.	U. to S.	Positive.
Brass	Wire, commercial.	S. to U.	Negative.
Zinc	Wire and foil.	U. to S.	Positive.
Nickel	Wire.	S. to U.	Negative.
Platinum	Wire and foil.	S. to U.	Negative.
Gold	Foil, purity 99.9 %.	S. to U.	Negative.
	Wire, commerc. pure.	U. to S.	
	Jeweller's 18-ct. wire and sheet.	S. to U.	
	Jeweller's 15-ct. sheet.	S. to U.	
Silver	Wire and foil.	S. to U.	Negative.
Aluminium	Wire and foil, pure.	U. to S.	Negative?
Cobalt	Rod, 8 mm. diameter.	U. to S.	Positive.
Magnesium	Ribbon.	S. to U.	Negative.
Tin	Foil.	S. to U.	Negative.
Lead	Foil (assay).	No current.	Nil.

S. means stretched. U. means unstretched.

It will be seen that in every case excepting that of aluminium, and one out of five specimens of gold, there is perfect correspondence between the direction of the thermo-electric current and the sign of Hall's effect. With regard to the aluminium, a piece of the foil was mounted on glass, and Hall's experiment performed with it. As was anticipated, the sign of the 'rotational coefficient' was found to be positive, like that of iron, zinc, and cobalt. Either, therefore, Mr. Hall fell into some error, or the aluminium with which he worked differed in some respect from that used by the author. The anomalous specimen of gold, being in the form of wire, could not be submitted to the same test: it probably contained some disturbing impurity.

[To the foregoing article, Dr. Hall has favored the editor of *Science* with the following reply.]

Mr. Bidwell's table is certainly very suggestive, but his 'explanation of the Hall phenomenon' cannot stand.

He makes this phenomenon to be an incidental result of the manner in which the metal strip is attached to the plate of glass. It is, he says, like a beam rigidly fastened at both ends, and weighted in the middle. Without discussing the closeness of this analogy, one can see, that if we fasten the strip by its middle, and leave it free at both ends, the conditions upon which Mr. Bidwell supposes the phenomenon to depend are quite changed.

After reading Mr. Bidwell's paper, I took a strip of soft steel, about one-tenth of a millimetre thick, and made the usual connections, but, instead of fastening the strip to glass with cement, so arranged it that it could at will be clamped across its middle or across the ends to a sheet of hard rubber. The end-clamps were about three centimetres apart, and the width of the magnetic poles between which the strip was placed was considerably greater than three centimetres. Now, when the strip was clamped across its middle and left free at the ends, and was made to conduct a current of electricity across the magnetic field, it was like a beam supported at the middle, and with a load distributed from end to end; but when the strip was clamped at its ends and left free in the middle, it was like a beam supported at both ends, and with a load distributed from end to end. Experiment shows that the effect is positive, as I have always found it in iron and steel, whether the strip be clamped in the middle, or at the ends.

There is one other consideration to be urged. Mr. Bidwell would, I suppose, account for the fact that the observed effect is proportional to the magnetic force by saying that the strain would be proportional to this force. But how will he explain the fact that the effect is nearly or quite proportional to the current, as was shown in my first paper upon the subject? Let us see what his theory leads to. Doubling the current, the magnetic force remaining unchanged, would double the strain. But a doubled strain, with a doubled current, would make the heating and cooling from the Peltier effect four times as great as before. This would deflect the equipotential lines four times as much as before; and, as these lines are only half as far apart as before, the transverse current would be eight times as great as before the direct current was doubled. The transverse effect, then, would be proportional, not to the current, but to the cube of the current. Edwin H. Hall.

Cambridge.

THE CREVAUX EXPEDITION.

E. Milhôme writes from Corumba, Sept. 24, 1883, to the Société de géographie in regard to the possible survivors of the Crevaux expedition. He believes that several survived for a time, but were afterward put to death by the savages. Information of any sort could hardly be obtained; as the Tobas had made ready for war, and retired to the interior, holding no further communication with the neutral tribes from whom the previous vague news had been derived by the whites. The Indian survivors, from their terror and sufferings, can afford little help. It is known that Branco, one of the party, in his capacity of soldier, was preserved alive by the natives to instruct them in the use of the fire-arms which they captured; and it is possible he may be still living, but, if so, has

probably been carried far into the interior. It is certain that the Tobas who massacred Crevaux's party are now provided with hatchets, knives, and Remington guns, which they have captured, partly from Crevaux, and partly from the Bolivian expedition of Col. Rivas. They are not, however, so formidable as might be supposed; since it seems their captive instructed them to aim in such a way as to render it almost impossible that any thing of a man's height should be hit by the ball; so that the guns are more terrifying than dangerous to their enemies. The second expedition sent under orders of Col. Fontana accomplished nothing. The third, organized by Col. Sola, and since commanded by Col. Hazetta, is at present penetrating the Chaco region, toward the banks of the Pilcomayo. Another better prepared Bolivian expedition was in contemplation under Col. Campu; but the writer, broken down by fever, was obliged to return to Corumba on his way to Buenos Ayres. He fears that all traces of the expedition of Crevaux are lost; that even their remains cannot be recovered, since the Tobas are in the habit of utilizing the bones as trophies or for religious purposes, so that they would be widely separated and unrecognizable. The vertebrae of the hated Christians are in special demand among the Toba women for use as rattles or rattling pendants worn during their dances. Altogether, the savagery of these Tobas seems to be more energetic than that of any other American aborigines. Milhôme has sent to Paris a complete collection of their arms, tools, instruments, and clothing, with an explanatory catalogue.

On the other hand, M. Paul Armand, in the Bulletin of the Marseilles society for December, without mentioning any date (but published before Milhôme's letter), says that the Argentine expedition to the Pilcomayo arrived safely in the early part of August, at the Bolivian town of Caiza, without the loss of a man, although having fought three battles with the Tobas. They ascended the Pilcomayo sixty leagues beyond the place where the Crevaux party was assassinated. The Bolivian congress has resolved that a colony named after Crevaux shall be established at that point, and that it shall be marked by a monument to the sufferers. Thouar arrived at Caiza on the 12th of July; having heard from some neutral Indians that two survivors, Haurat and Branco, were prisoners with the Choroti Indians of the Rio Abajo. He had had some communication with the Tobas, and obtained some relics, among other things a barometer which had belonged to Crevaux. He intended to leave Teyo about Aug. 10, and pass completely round the north Chaco, on the left bank of the Pilcomayo. In January it was stated to the Société de géographie that Thouar had arrived safely at Assuncion, and was about to embark for France, where he was expected before this time. Nothing further is said in regard to his search for Crevaux; but it is stated that the most important result of his voyage will be the opening of a practicable commercial route between Bolivia and Paraguay, giving opportunities for a reciprocal commerce now valued at twenty million dollars.

A NEW THEORY OF HEREDITY.

The law of heredity: a study of the cause of variation, and the origin of living organisms. By W. K. BROOKS. Baltimore, *Murphy*, 1883. 12+336 p., illustr. 16°.

JAEGER is quoted by Semper as saying that there has been enough Darwinist philosophizing, and that it is now time to subject the numerous hypotheses to the test of investigation. While this is undoubtedly true, some hypotheses are necessary; and even incomplete and erroneous ones may be of great service by offering a series of definite problems for solution, instead of a chaos of facts. "An honest attempt to reason from the phenomena of nature can hardly fail to result in the discovery of some little truth." This is the keynote of the book before us, which is therefore worthy of very careful consideration, however unsatisfactory it may prove to be as an explanation of the great problem of heredity.

The theory proposed in this book is a modification of Darwin's hypothesis of pangenesis, reconstructed with a view of avoiding the many difficulties in the way of that hypothesis. Brooks's theory, very briefly stated, is as follows. 1. The union of two sexual elements gives variability. 2. In all multicellular organisms the ovum and the male cell have gradually become specialized in different directions. 3. The ovum has acquired a very complex organization, and contains material particles of some kind corresponding to each of the hereditary species characteristics. 4. The ovarian ova of the offspring are the direct and unmodified descendants of the parent ovum. 5. Each cell in the body has the power of throwing off minute germs. During the evolution of the species, these cells have acquired distinctive functions adapted to the conditions under which they are placed. When the function of a cell is disturbed through a change in its environment, it throws off small particles, which are the germs or 'gemmules' of this particular cell. 6. These germs may be carried to all parts of the body, and penetrate to an ovum or to a bud; but the male cell has acquired a peculiar power to gather and store up germs. 7. When impregnation occurs, each gemmule impregnates that particle of the ovum which will give rise in the offspring to the cell corresponding to the one which produced the gemmule; or else it unites with a closely related particle, destined to produce a closely related cell. 8. In the body of the offspring this cell will be a hybrid, and tend to vary. 9. The ovarian ova of the offspring inherit the properties of the fertilized

ovum directly, and the organisms to which they give rise will tend to vary in the same manner. 10. A cell which has varied will continue to throw off gemmules, and so cause variations in the corresponding parts of the bodies of descendants, until a favorable variation is seized upon by natural selection. 11. The ovarian ova will directly inherit the selected variation, and will transmit it as an hereditary race characteristic without the agency of gemmules. 12. The occurrence of a variation, but not its precise character, is due to the direct action of external conditions.

These positions Professor Brooks endeavors to establish by a great number of facts, taken almost exclusively from Darwin. He first combats the view that the sexual elements play similar parts in reproduction, and the objection seems to be well taken; though, when he says that it cannot be shown that either sex may transmit *any* characteristic whatever, he pushes his objection too far, as is demonstrated by a multitude of facts in the breeding of domestic animals.

Having stated the theory, the author devotes a large part of his book to the evidence in its favor. From the study of hybrids he concludes that hybrids and mongrels are highly variable; that the children of hybrids are more variable than the hybrids themselves; and that, from the evidence of reciprocal crossing in the case of hybrids, variation is caused by the influence of the male. The evidence from variation is then considered, showing that variation is more common in sexual than in asexual reproduction (in plants at least); that changed conditions cause variation, not directly, but in subsequent generations; that specific characters are more variable than generic; that parts excessively developed in males are more variable than parts especially developed in females. Professor Brooks next takes up the very complex subject of secondary sexual characters, and shows from various kinds of evidence that the male is more variable than the female; and that the male has led the way in evolution, while the female has followed. One of the most important aspects of the hypothesis, the author considers to be the manner in which it removes objections to the theory of natural selection, by showing that large numbers of animals vary similarly and simultaneously, and so give an opportunity for natural selection to come into play.

Now, how far can this ingenious and ably supported hypothesis be regarded as a permanently valuable contribution to science? One great objection is apparent at the very outset, — that the author has not gone to nature for his facts, but has taken them almost entirely from Darwin's works, as he candidly says. This must necessarily impair the value of his conclusions. The whole work bears the stamp of being merely an ingenious attempt to supplement Darwin's hypotheses, and re-arrange his facts, and might have been written by one whose knowledge of biology had been drawn almost entirely from Darwin's books. The objection which Mr. Lewes [1] made to pangenesis holds equally well against this hypothesis. "The hypothesis is thus seen to be one wholly constructed out of suppositions, each and all of which may be erroneous, every one of them being necessary to the integrity of the scheme." Thus, the existence of gemmules is a supposition; that cells throw them off when disturbed is a supposition; that the male cell has acquired a special power of gathering and storing these germs is a supposition. Scarcely a single proposition of the hypothesis can be regarded as in any way proved. Then, again, some of the apparently simple assumptions really involve a number of others, equally without evidence. Thus, when it is said that the ovarian ova, being the direct descendants of the fertilized egg, inherit its peculiarities, we have no explanation offered for what is perhaps as great a mystery as the main problem itself. The ovarian ova are derived from the fertilized ovum through an immense number of intermediate cells, most of which become indifferent epithelium. We must, then, assume that the gemmules are all segregated together, and transmitted unchanged from cell to cell till they finally reach the ovarian ovum, — surely a very forced supposition.

The evidence by which Professor Brooks endeavors to support his hypothesis is by no means convincing: usually all that can be said of it is, that it does not contradict the view. In spite of his evident candor, the author has not always resisted the temptation of straining his points to the uttermost limit, often preferring a far-fetched and doubtful explanation to an obvious one close at hand, as in the cases of the zebra and niata hybrids on p. 130. The statement that the peculiarities of the niata breed of Paraguay cattle are probably due to a *reversion* to the type of Sivatherium will be an amusing one to paleontologists.

Then it is not at all clear, from the evidence presented, that this hypothesis will account more satisfactorily for the greater development of the male in those species in which the sexes differ than does Darwin's theory of sexual

[1] *Fortnightly review*, new series, vol. iv., p. 508.

selection: for, admitting Professor Brooks's doctrine, that each individual inherits *all* the characteristics of the species, and that the female function prevents the development of the male characters (though they may appear when that function is destroyed), it is plain that those characters are either incompatible with the female function or useless to the female, and hence there is no reason why she should acquire them; while their presence in the male, to which they are of obvious advantage, is in most cases to be accounted for by sexual selection. On the other hand, it is obvious that all the complex apparatus of uterus, placenta, and similar organs, must have originated with the female. We cannot agree with Professor Brooks, that the presence of mammae in the male is an indication that the mammary function was originally a male characteristic, any more than that the presence of rudimentary stridulating organs in female Orthoptera shows that these were first acquired by the female. Why should Professor Brooks adopt exactly opposite explanations for precisely parallel cases?

The propagation of cells by means of gemmules is not only purely hypothetical, but, apparently at least, opposed to what we know of the mode of cell-formation. Cells arise only by division of some pre-existing cell, and never seem to arise spontaneously, as would very probably be the case if their propagation by gemmules were at all common. Nor does the process of impregnation, as actually observed, lend support to the new hypothesis; for the head of the spermatozoon coalesces with the nucleus of the ovum, apparently without loss of bulk, or in any way indicating an emission of gemmules. The influence of the male element seems rather to consist in modifying the action of the egg-nucleus.

Mr. Conn's very obvious objection (given on p. 294), that in many cases unfavorable conditions would not act upon certain cells, causing them to emit gemmules, but would result in the destruction of the animal, seems entitled to more weight than the author is inclined to give it. Any hypothesis that fails to account for so large and important a class of facts cannot be called complete.

Want of space compels the omission of many other objections, as well as the consideration of Professor Brooks's views on reversion, natural selection, and the intellectual differences between men and women.

But, in spite of all that has been said, Professor Brooks is entitled to the thanks of all students of biology for his clear statement of the problem, and the many suggestive fields for investigation here opened. The student of heredity will find in this book just what he needs to give him a clear conception of how the problem is to be attacked. The book is one of remarkable ability. The way in which apparently disconnected series of phenomena are brought together and shown to be special cases of one general principle, is indeed masterly. Even if every single proposition of the hypothesis should prove to be without foundation, and the hypothesis entirely untenable, Professor Brooks must always be credited with having made a most important step in advance. Assuming that the problem of heredity is at all capable of solution, some such preliminary clearing of the field is a necessity. If different observers will devote their energies to following up the various lines of inquiry which Professor Brooks has so ably suggested, we may be sure of most valuable and fruitful additions to our knowledge. To use Mr. Lewes's words, "even should the hypothesis prove a will-o'-wisp, it is worth following if we follow circumspectly, for it hovers over lands where we may find valuable material. As an hypothesis, it so links together wide classes of facts that it may be a clew to great discoveries."

WATTS'S MANUAL OF CHEMISTRY.

A manual of chemistry, physical and inorganic. By HENRY WATTS. Philadelphia, *Blakiston,* 1884. 16+595 p. 8°.

FEW text-books of chemistry have been more successful than the 'Manual of elementary chemistry' first published in 1845 by Professor George Fownes. Fownes, who was but thirty years of age at the time, held the chair of chemistry in University college, London. His work had marked success from the very beginning, and he was called upon to prepare three editions in the succeeding four years. The third, however, appeared posthumously; for Fownes died in January, 1849, at the early age of thirty-four. Under the editorship of the late Dr. H. Bence Jones, and afterwards of Dr. A. W. Hofmann, the work appeared at frequent intervals in six editions; and, notwithstanding the constant additions of large amounts of new and important matter, the familiar name 'Fownes's chemistry' was retained. The tenth edition was edited by Dr. Bence Jones and Henry Watts, and appeared in 1868; another edition, by Henry Watts, followed in 1872; and finally a twelfth, greatly increased in size, and issued in two volumes devoted to inorganic

and organic chemistry respectively, completed in 1877 the long and valuable series.

The honorable career of this standard work reminds us of that other remarkable handbook, the '*Cours de chymie*' of Nicolas Lemery, of which the first edition appeared in 1675, and the fourteenth, greatly enlarged by Baron, in 1756, eighty-one years after.

The new work by Henry Watts is confessedly "founded on the well-known manual of chemistry of the late Professor Fownes;" and, such being its origin, we are not surprised to find that it wears the garb of a familiar friend. The learned editor of 'A dictionary of chemistry' has in this manual dropped the name 'Fownes' from the titlepage, and given us a revised edition bearing his own name. And this he undoubtedly has a right to do, if one takes into consideration the great alterations and additions made in the preceding editions with which his name was associated, together with the improvements in the one before us.

The present volume commences with a short sketch of the more important elementary bodies, the principal laws of chemical combination, the principles of nomenclature, and the representation of the constitution and reactions of bodies by symbolic notation. In the preceding edition (twelfth) of Fownes the three topics last named were treated at p. 123 of the volume: here they appear at p. 7.

This introduction is followed by a section on chemical physics which has always occupied a prominent place in the several editions of Fownes. The next section contains a description of the non-metallic elements in the following order: hydrogen, chlorine and its analogues, oxygen, sulphur and its analogues, nitrogen, phosphorus, arsenic, boron, silicon, and carbon. This is succeeded by a fuller consideration of the general principles of chemical philosophy, embracing sections on quantivalence, the periodic law, crystallization, and chemical affinity. At this point is introduced the subjects of electro-chemical decomposition, or electrolysis, and the chemistry of the voltaic pile, which are thus divorced from their rational connection with the chemical physics in the earlier portion of the work. The latter half of the volume treats of the metals in their usual systematic order.

Watts's chemistry, on the whole, differs more from its predecessor in the arrangement of material than in the introduction of novelties; still, we find new paragraphs here and there, embodying late discoveries. The work shows evidences of having been rather hastily prepared. Thus, while the newly announced elements, scandium, decipium, ytterbium, and samarium, are briefly described in their proper connection (pp. 458 to 463), only two of them (Sc and Yb) obtain positions in the list of elementary bodies on p. 3. Again: under oxygen we find no mention of its liquefaction, though in the section on chemical physics the experiments of Cailletet and Pictet are, far too briefly, chronicled. Ozone fares very badly, obtaining no recognition whatever in the body of the work, and being relegated to a single page (584) at the very close of the appendix; and there it is very inadequately treated. Its liquefaction by Hautefeuille and Chappuis is not mentioned. The page is a simple condensation of the two pages given to the subject in the preceding edition of Fownes, without the addition of a single new fact. The atomic weight of antimony still appears as 122, notwithstanding the great weight of evidence in favor of 120. Meyer and Seubert make Sb = 119.6.

The well-worn woodcuts, too familiar and never very attractive, still do service in illustration. The volume contains thirty-four pages more than the English edition of the last issue of Fownes. In spite of some blemishes, however, Watts's Chemistry sustains the high reputation of its lineal ancestor, and well deserves a large patronage.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Topographical work in North Carolina. — Party No. 1 of the Appalachian division was in charge of Mr. Charles M. Yeates, topographer, and, during the seasons of 1882 and 1883, surveyed the area lying between the Blue Ridge and the Tennessee line in North Carolina, with the exception of Watauga, Ashe, and Alleghany counties. This area lies between the 35th and 36th parallels, and extends from the 82d to the 84th degree of longitude, including the most mountainous portion of the state, and that which is usually designated as western North Carolina.

The state line separating North Carolina and Tennessee follows the summit of the Alleghany Range, which, in its different parts, has received various specific names; such as the 'Unaka,' the 'Bald,' and

the 'Smoky' Mountains. These names are applied to the portions that lie between terminal points where the rivers intersect it. Other local names have been applied to minor subdivisions and to summits; but the most prominent portions are known to the native population by names which agree with those used on the existing published maps of the region.

The Alleghany Range and the Blue Ridge are in general parallel to each other. The greatest distance between them is across Haywood and Transylvania counties, where they are fifty-five miles apart; while where they are closest they are only eight miles apart. They are also parallel with the coast-line; and a contour map of the state will show that it is crossed from south-west to north-east by a series of parallel ridges from a point within four miles of the coast to the Blue Ridge. The first of the ridges reaches an elevation of between seventy and eighty feet; and the succeeding ones increase in height, one after the other, until they culminate in the mountains of the western part of the state, where the general elevation is from 4,000 to 6,000 feet.

The Blue Ridge in this section is of peculiar interest, because in its details its course is very crooked. It is entirely unlike the long, straight ridges of eastern Tennessee. It enters the state from Virginia with an elevation of 4,000 feet above sea-level, and reaches its maximum height of about 6,000 feet at Grandfather Mountain, which is the highest summit in the ridge; although hitherto, High Pinnacle, near the Black Mountains, has enjoyed that reputation. The next highest point to the southward is Sugar Mountain, with an elevation of 5,200 feet. From the latter point the range drops to low summits, that do not usually exceed 3,600 feet above sea-level. These continue southward to Humpback Mountain, a distance of fifteen miles, when there is a rise to 4,800 feet; and from here to Bear Wallow Mountain the range is of a quite respectable elevation. At High Pinnacle, where the ridge joins the Black Mountains, the height is 5,600 feet. From Bear Wallow southward, the range is comparatively insignificant; but, as the state line is approached, it once more rises, and is of considerable importance as it passes from the state.

South and east of the Blue Ridge are the lowlands, while to the westward is the high plateau section. The difference in elevation between the two is generally about 1,000 feet in a distance of some two or three miles. The difference in seasons, between the two sections, is from two to three weeks. A view of the ridge from the west, at many points, would give an idea of insignificant elevation; whereas the same section, seen from the east, would be quite imposing. This peculiarity of the ridge is characteristic in North Carolina, with the exception of the section lying between Humpback Mountain and Sugar Mountain, in which the eastern and western descents are about equal.

North Carolina, west of the Blue Ridge, contains about 75,000 square miles, of which some 5,500 have already been surveyed, — 4,000 by Mr. Yeates's party, and 1,000 by Mr. Bien. The remaining portion will be surveyed by Mr. Yeates during the next season. The map will be on a scale of two miles to the inch, with contours two hundred feet apart vertically, which will show the country in considerable detail. The existing maps of the region have all been generalized, and are more or less indefinite.

The topographical features of the region are entirely dissimilar to those of the adjacent portions of Virginia and Tennessee. In the latter the strong orographical features of West Virginia and south-western Virginia gradually die out, while in North Carolina there appears to be no regular system when compared with the other states. The only resemblance is, that the Blue Ridge and the Alleghany Range are in general parallel with the ranges of East Tennessee. The distinctive topographical feature in North Carolina is the existence of cross-ranges which connect the Blue Ridge with the Alleghany Range, making immense drainage-basins, whose outlets are through the latter to the western river-systems. These cross-ranges, with the exception of the Great Smoky Mountains, are of more importance than the ranges which they connect; as they generally have a greater altitude, many of the summits reaching a height of more than 5,000 feet. The principal ones are the Rich Mountains, the Cockscomb Range, the Newfound Mountains, the Great Balsam Mountains, the Cowee Mountains, and the Nantehaleh Mountains. The Balsam Mountains share with the Smoky and Black Mountains of North Carolina, and the White Mountains of New Hampshire, the distinction of being the highest mountain masses in the eastern United States. The spurs of the cross-ranges form an intricate maze of drainage and topographical details.

The Black Mountains, a range ten miles in length, with seventeen summits, are neither one of the cross-ranges nor one of the transverse ranges, but a spur from the Blue Ridge, with which they are parallel. The highest point is Mitchell's High Peak, which is the highest summit east of the Rocky Mountains. Mr. Yeates, by barometrical measurement, obtained for it a height of 6,717 feet, which is six feet higher than any previous measurement. The coast and geodetic survey, by means of vertical angles, fixed its height at 6,688 feet above sea-level. The elevation given by Professor Guyot is 6,707 feet. Major James W. Wilson, chief engineer of the W. N. C. R.R., at the request of Gov. Swain of North Carolina, ascertained its height by means of levels, and fixed it at 6,711 feet.

The French Broad River is the principal stream of western North Carolina, and is a stream of much beauty, flowing through a valley of great fertility. Its course in the Transylvania valley is very sinuous, and its flow sluggish. The Indians designated this portion of its course 'sleeping serpent.' From Dunn's rock, a precipice that overlooks it, thirty-six bends can be counted as the river winds in its tortuous course through the farms in the valley below. Almost all the small streams, as well as the large rivers, of the section, have good water-powers, which must eventually be utilized for manufacturing purposes.

The timber-lands of the region form immense unbroken forests, exceptionally fine both as to density of growth and the character of the timber. Among the varieties of wood are maple, poplar, linden, balsam, cedar, hickory, ash, beech, birch, cherry, black walnut, and many varieties of oak. Some of the trees grow to an enormous size; and many men in this section, who a few years ago considered themselves poor because they possessed only a wilderness of forest, are beginning to realize that they are comparatively rich, the sale of a few individual trees frequently sufficing to give them an income for a considerable time. These trees are bought by speculators, who, in turn, sell them to other speculators, who may dispose of them to third parties, until finally a portable saw-mill is brought into the region, and the timber is prepared for market. A view from one of the cleared summits impresses one with the extent of the forests, which are, of course, broken here and there by many dots of cultivated land, both in the valleys and on the mountain sides. The country, however, is comparatively undeveloped. The soil is good, but farming is carried on in a primitive way and on a contracted scale. There is plenty of good grazing-land, and cattle are raised to a considerable extent. They are allowed to run wild among the mountain ridges; and the cost of keeping them is small, as they are allowed to find subsistence for themselves.

The mineral wealth of the region is well known. In fact, it has been said that almost every mineral or ore found within the limits of the United States can be found in North Carolina. The gold-mines east of the Blue Ridge have produced millions of dollars, notwithstanding the hinderances of swindlers and speculators. Mica-mining is one of the profitable industries of the region mapped by Mr. Yeates, and is carried on in nearly all of the counties west of the Blue Ridge. Kaoline and corundum mines are also worked, and a large deposit of talc is attracting considerable attention, while tin is the latest discovery.

PUBLIC AND PRIVATE INSTITUTIONS.

Peabody academy of science, Salem, Mass.

The director's trip to Japan. — Professor Morse left Salem early in the spring of 1882 for the purpose of visiting Japan and China, and reached Japan in May. On his arrival in that country he had several interviews with Mr. Kato, the director of the Imperial university, and told him that his time was to be divided between collecting ethnological material for the museum of the academy, and the study of ethnology and archeology, and specially the ceramic art. A suite of rooms in a little house near the astronomical observatory was fitted up for him by the university, and given to him free of cost during his entire stay. Rooms and closets in other college-buildings were given to him for storage purposes; and, indeed, every thing was done by the Japanese authorities to facilitate his work, without which assistance little progress could have been made in the task he had planned.

In return for the collections of corals sent out by the academy for the educational museum, the educational museum presented to the academy a large collection of tools illustrating the trades of Japan. Great credit is due Mr. Tejima, the director of the educational museum, for the thorough way in which this collection was brought together. Not only were the various implements collected; but in many cases partially completed specimens of the work, as well as colored sketches, accompanied the tools.

Through the influence of Dr. W. S. Bigelow, the academy is indebted for the remarkable collection of weapons which were presented by a famous sword-merchant, Mr. Machida Heikichi. Having explained to Mr. Machida the objects of the academy, and the nature of its museum, Mr. Machida, with great pains, and at his own expense, brought together the invaluable collection of swords, spears, bows and arrows, and other weapons which now enrich the academy's museum, and presented them outright, properly labelled and prepared for shipment.

Mr. Takanaka Hachitaro supplied the Japanese names for all the objects collected. He also presented many objects of household use, and clothing. Professor Mitsukuri, at great trouble, sought out the proper person to whom was intrusted the making of the large figures which now adorn the museum, and personally superintended their dressing and arrangement.

Korean collections. — Through Capt. Hammond Professor Morse was made acquainted with Count von Mollendorff, then on his way to Korea as special commissioner for China. He authorized him to spend a limited sum for purchases of ethnological materials in that country, and gave him a brief list of desirable objects. The results of his work, filling four cases, have already been received and unpacked. They arrived in fair condition; and as far as he knows, this is the first collection of Korean objects ever sent from that country. In this connection it is proper to mention, that members of the Korean embassy who visited this country last year presented a number of objects to the academy; and one of their suite, Mr. Yu Kil Chun, who remained in this country, and who is now living in Salem, presented his entire suit of clothing, and other objects, to the museum.

Accessions to the museum. — These have been more numerous and more valuable than during any year, perhaps, since the foundation of the East India marine collection in 1799. The principal ones are as follows: —

Morse collection, Japan, 680 numbers; Morse collection, elsewhere, 141; William Dolan, China, 50 specimens. Additions to county collections: plants, 54; mammals, 50; and archeology (85 lots), 322 specimens (this last includes about 15 lots, 50 specimens outside); botanical, 200; other accessions, 300; models of boats, 12.

Visitors to the museum. — Thirty-six thousand and fifty-six persons have visited the museum during the year. The greatest numbers on single days were: Feb. 22, 440; July 4, 182; April 5 (Fast), 346; Sept. 25 (first day of cattle-show), 384; Sept. 26 (second day of cattle-show), 936; Nov. 29 (Thanksgiving),

336. July 4 is mentioned to show how few persons are often at the museum on holidays now, as compared with the attendance on such days in former years, especially in summer, when 'attractions' are offered at the 'Willows,' 'Point of Pines,' and other popular resorts in the neighborhood.

The above figures are undoubtedly under the actual numbers. There is a steady increase, each year of late, in the regular daily attendance, and a corresponding decrease on popular holidays.

The specimens which seem to be of most interest to the general public are the life-size figures from China, Japan, India, and other countries; the general collection of mammals and birds; the Essex county animals and woods; and, perhaps more than any thing else, the human skeletons and crania. The carving 'Heaven and the day of judgment' of course holds the first place for the seeker after the curious and wonderful.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Ottawa field-naturalists' club, Canada.

March 13. — Mr. W. P. Lett read a paper on the deer of the Ottawa valley. Of these, the most important as regards size is the moose, or American elk (Alce americanus), which unfortunately, owing to indiscriminate slaughter and illegal hunting, is rapidly becoming very rare, except in remote districts along the northern tributaries of the Ottawa. The woodland caribou, or reindeer (Rangifer caribou), formerly frequented the whole country on the north side of the river, but was only an occasional straggler on the opposite shore. Like the moose, it has been driven northward, and much diminished in numbers, although sometimes still found on the Des Licores River, fifty or sixty miles from its mouth, on the upper Gatineau, and to the north of Lake Nippissing. It is the swiftest and wildest of all deer; and the only successful method of capturing it is by still-hunting. The magnificent wapiti, or great stag (Cervus canadensis), falsely called the American elk, was, within the memory of persons still living, an inhabitant of the great hardwood forests along the Ottawa, and was seen within four miles of the spot where the city now is. Fragments of its enormous antlers are still turned up by the plough in various localities, but the stately monarch of the forest has retired to the far northwest territories. The common red or Virginian deer (Coriacus virginianus) is still found within a few miles of Ottawa, but owing to pot-hunting and slaughtering during the winter, when the snow is deep, is becoming annually less plentiful. Not many years ago immense yards, containing hundreds of deer, existed along the various tributaries; but, except in remote districts, the yards are now scattered and small, and the deer confined chiefly to the large swamps. Reference was made by the lecturer to the variety of this species known as the 'spikehorn,' and to interesting piebald and white specimens which had been observed by him. A fine collection of heads and antlers of the several species was shown, including some abnormal antlers from old red bucks.

Society of arts, Boston.

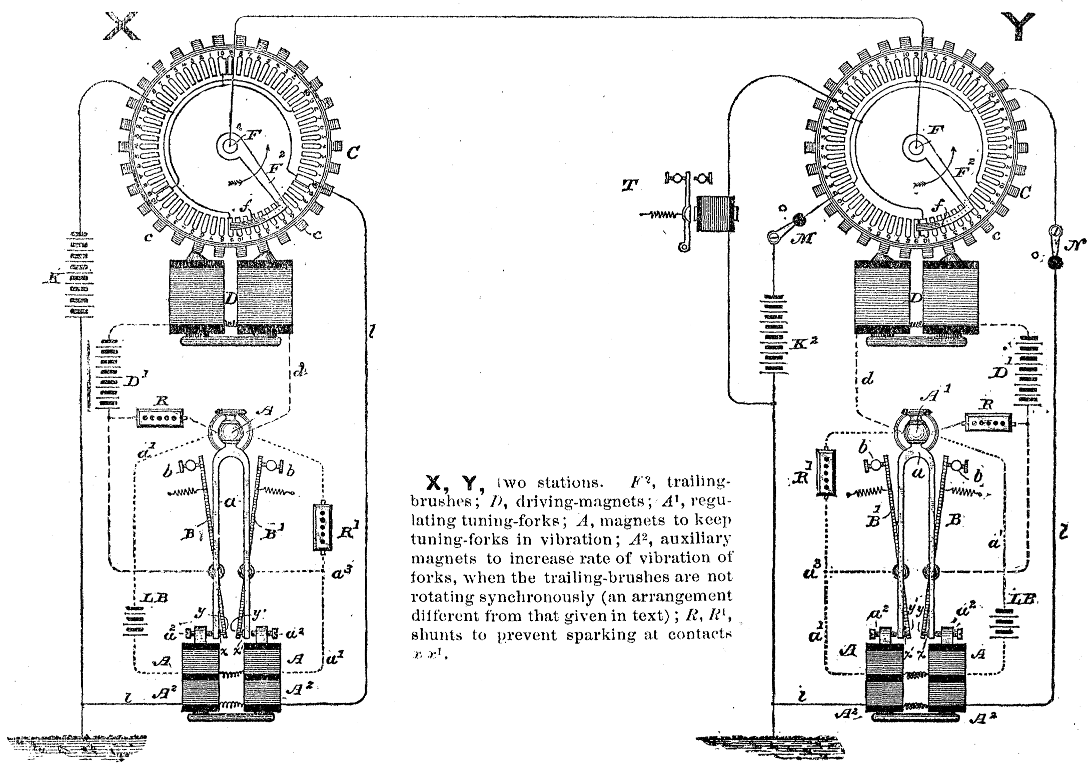
March 13. — Mr. P. B. Delany of New York gave the first public exhibition and description of his new system of synchronous, multiplex telegraphy, — the result of inventions by Mr. P. La Cour (1878), Mr. E. A. Callahan of New York, and himself (1883). By this system any number, up to twelve, of fast Morse circuits can be simultaneously worked over a single wire, the messages going in either direction on any circuit; also a greater number of slow Morse circuits, and as many as seventy-two printing-circuits.

At each end of the main line a drum, called a distributer, is maintained in uniform rotation about a vertical axis by the intermittent attraction of an electro-magnet on the toothed circumference of a horizontal circular plate carried by the drum. A tuning-fork, vibrated electrically (about eighty-five vibrations), opens the motor circuit at each vibration, and thus produces the intermittence in the motor magnet driving the distributer. If the forks at either end of the line were in absolute unison, and the toothed circumference had the same number of teeth each, the drums would rotate synchronously. The impossibility of absolute and continued unison is met by automatic regulation of the rate of the forks, the principle involved being an automatic shunting of a resistance-coil which is normally in the circuit driving the fork; thus increasing the current in that circuit, and hence amplifying the excursion of the prongs, intensifying the field of magnetic force in which this vibration occurs, and thus diminishing (by even five per cent) the rate of the fork. This slowing-down of the fork would immediately result in a corresponding lessening of the speed of rotation of the distributer at that end of the line.

The main principle of the multiplex use of the single line consists in giving the line synchronously, and in sufficiently rapid succession, to the corresponding instruments or circuits at the opposite ends of the line. In the apparatus shown, the rotating drum or distributer carried a brush which trailed over a circular series of eighty-four narrow, insulated, radial plates or segments of metal. Of these, twelve were utilized for the synchronizing arrangement, and the remaining seventy-two were divided among six circuits; the terminus of the same circuit being thus connected to twelve equi-distant segments, each circuit containing merely the ordinary polarized relay, reversing key and ground; the relay serving to close the local circuit through a sounder, as usual. Thus, when the brushes at both ends of the line make contact at the same instant with any one of the twelve segments of the same circuit, that circuit, and no

other, can be in operation. As the synchronous rotation continues, each circuit will be in turn closed through the single main-line wire in succession, and each twelve times in a rotation, and thirty-four times in a second. The frequency of successive closings of the same circuit is thus so great, that, in the fast-working Morse instrument, one closing at least will occur in even the shortest signal, so that no dot can be missed.

The automatic synchronizing device consists in having three equi-distant segments in each set about twice as broad as the others, the segment next preceding each of these being idle. The relative positions of these broad segments are not the same in the two sets; but, in the position corresponding to every broad segment of either set, there is, in the other set, an ordinary narrow segment connected with a grounded battery (the same battery serving, of course, for all three segments of each set). The broad segments are all grounded. The two distributers will be synchronous when the brush of one is on any one of its narrow-battery segments at the same instant that the brush of the other is on the idle segment next preceding the broad one. If the synchronism is perfect, both brushes will pass off these segments at the same instant. If, however, the brush on the idle segment is ahead of such a synchronous position, it will pass on to the broad segment while yet the other brush is on the narrow-battery segment: a current through the line and broad-segment contact to ground will ensue. This current excites a relay (located between the broad segment and the ground), which opens a local relay circuit (normally closed). As the armature of this second relay comes sharply to its back-stop, it short-circuits the resistance-coil previously alluded to as being in the circuit of the fork-driving battery, and thus effects a slowing-down of the fork and distributer, as before described. As there are three broad segments to be touched in each revolution, this synchronizing pulse may be sent thrice, twice, once, or not at all, as may be necessary, in either direction during each revolution. The two distributers may thus be kept within one-quarter of the width of the narrow segments of each other; this corresponding to a synchronism of about 0.001 of a second, or about 0.002 of a revolution.



X, Y, two stations. F^2, trailing-brushes; D, driving-magnets; A^1, regulating tuning-forks; A, magnets to keep tuning-forks in vibration; A^2, auxiliary magnets to increase rate of vibration of forks, when the trailing-brushes are not rotating synchronously (an arrangement different from that given in text); R, R^1, shunts to prevent sparking at contacts x x^1.

Trenton natural history society.

March 11. — W. S. Lee remarked on New Jersey as a paradise for the botanist, particularly commending the region about Trenton as one rich in rarities of plant-life. A certain hillside sloping to the south presents many spring flowers two weeks earlier than similar locations in even the same state; and several rare species grow there, among others Corydalis aurea and C. flavula. Other rare New-Jersey species mentioned as found near Trenton were Fedia olitoria, Ellisia nyctelea, Onopordon acanthium, Potentilla

argentea, Viola striata, and Cornus canadensis. —— Dr. T. S. Stevens exhibited a little garter-snake (Eutaenia sirtalis) preserved by nature in an interesting manner. It had been taken from beneath a wheat-stack in its present condition, the body thrown in graceful coils and curves, the head erect, the whole appearing like a snake on the alert, yet dead, perfectly dry and mummy-like, and presenting only the slightest changes externally. According to Dr. Stevens, it has remained in this condition, without any special attention, for ten years.

Academy of natural sciences, Philadelphia.

March 4. — Professor Joseph Leidy stated that he had recently been supplied with specimens of a wheelless rotifer, attributed to Apsilus, which had been found abundantly last autumn, in a pond at Fairmount Park, attached to Anacharis, and in the Schuylkill River, near by, attached to Potamogeton. They were recognized as Dictyophora, first described in 1857; and as a result of the last examination, Professor Leidy was led to the opinion, that this form, the Apsilus lentiformis of Mecznichow, the Capelopagus lucinedax of Forbes, and the Apsilus bipera recently described by Miss Foulke, are all the same species. In the recent specimens, he had recognized the lateral antennae ending in exceedingly delicate and motionless cilia, as indicated by Mecznichow, and which previously, from the wrinkled condition of the specimens detached from hard objects, had escaped his attention. In all the forms described, the prehensile cup, in the same manner, is projected from, and withdrawn within, the mouth of a compressed oval or nearly spherical carapace, dotted with minute tubercles. This cup, substituting the usual rotary organs of rotifers, communicates with a capacious, variably sacculated, and dilatable stomach, followed by the ordinary gizzard with its mastax, and then a second sacculated stomach. The size of the European forms is fully thrice that of the one now described. —— Miss S. G. Foulke described a species of ciliated infusorian of the genus Trachelius, found in the form of a white speck in water from the Schuylkill River. —— Rev. Dr. H. C. McCook, referring to the spinning-work of spiders, stated that the orb-weavers have, as a rule, but one egg-nest; but this, in the different species, varies widely in form, size, position, etc. There are, however, four species which make several cocoons in connection with their webs. The labyrinth spider, Epeira labyrinthica, weaves a web of right lines crossing at all angles above the orb-web. In the midst of these right lines the spider lives, almost always under a dried leaf. Under the leaf is a little white silk tent or belt-shaped nest connected with the web by a trap-line. Hanging above the tent are nearly always five cocoons, braced above and below by a strong silken line. They consist of a lower cup portion, covered by a sort of lid, and each contains about twenty eggs. The tailed spider, Cyrtophora caudata, generally makes five nests, containing in the aggregate a hundred or a hundred and twenty-five eggs. These are strung along the median line of the orb-web. They are at first composed of a yellowish, slightly viscid plush, and are afterwards covered with fragments of captured insects. This may be an instance of protective mimicry, as the cocoons so covered closely resemble the spider itself; or it may be due to the maternal impulse to protect the repositories of the young as far as possible. Epeira basilica, which forms a beautiful dome-like web placed over a silken sheet, suspends its cocoons vertically in the centre of the snare. They consist of a dusky gray silken sac, within which is a hard ball like a cherry-stone. This ball is quite black, but proves, when placed under a microscope and illuminated, to be woven of a fine-textured yellow silk. It is filled with finely chopped silk, in which the young spiders are hatched. Uloborus riparia makes a horizontal web, the cocoons being strung horizontally from the centre. They are double cones, covered with little protective points.

Mathematical section, philosophical society, Washington.

Jan. 30. — Mr. G. K. Gilbert made a communication on the Knight's tour, on other fields than those of sixty-four squares. He showed that a complete tour was impossible if the number of squares was odd; that a tour having *bilateral* symmetry (latter half of the moves symmetrical with former half, with respect to a line through the centre of the field) was impossible if the number of squares was divisible by four, and hence altogether impossible on square fields; that a tour having *quadri-radial* symmetry (divisible into four parts, which exactly repeat themselves when the board is turned through a right angle about the centre of figure) was impossible if the number of squares was divisible by eight; that the only symmetry possible on the ordinary chess-board was therefore *bi-radial* (of two parts that coincide when the board is turned through two right angles). Upon a field of thirty-six squares, twenty tours with bi-radial symmetry are possible: of these, five have also quadri-radial symmetry.

NOTES AND NEWS.

THE following communication, kindly placed in our hands by the committee on invitations and receptions of the Philadelphia meeting of the American association, will interest the members of the association: —

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE,
22 ALBEMARLE STREET, LONDON, W.,
Feb. 27, 1884.

DEAR SIR, — The resolution of the American association, inviting members of our association to visit Philadelphia and take part in its meeting, was read to our general committee by Principal Dawson, and was received with enthusiasm. No definite resolution in reply was, however, proposed; because it was felt that the visit to Canada was only then assuming definiteness as to its outlines, and it was impossible to say what arrangements might be made in that country. But the members of the association were fully sensible of the courtesy and kindness of their American brethren; and the enclosed resolution, which was passed by the council at their last meeting,

and which I should have forwarded to the secretary of the American association as soon as the minutes had been confirmed, will, I hope, be regarded as a reply from our association.

The kind invitation repeated in your letter shall be embodied in a circular which we are about to issue to our members. I fear that at present it will be impossible for me to give you any idea of what number of our members will be able to avail themselves of the hospitality offered by your committee at Philadelphia, because at present only the bare outlines of the proposed proceedings at Montreal and in Canada are before them. When the immediate pressure of the issue of this circular is over, I will do my best to find out.

Very truly yours,
T. G. BONNEY, *secretary*.

Dr. P. FRAZER, *secretary*.

The resolution mentioned reads, —

"It was resolved to receive the standing committee and fellows of the American association on the footing of honorary members at the Montreal meeting, and the secretary was instructed to give intimation of this resolution, as far as possible, to the persons concerned."

Another letter just received from Professor Bonney encloses two circulars, — one containing a reprint of the resolution above referred to, and an invitation to the person to whom it is sent to attend the meeting in Montreal; stating, that, on its presentation to the secretary on or after Aug. 25, a ticket of honorary membership will be received in exchange: the other circular is an admirable condensation of such information as the British member is likely to need. Thus, the first two pages are devoted to the steamer-lines and the fares thereon; three pages are concerned with the railways; and it may be mentioned in this connection, that the Canadian government has promised to convey all British association members, associates, and their family parties, free of charge. The Canada Pacific and the Canada Atlantic offer them free excursions, the former granting free passes up to the date of their special free excursion to the Rocky Mountains (for a hundred and fifty only). The remaining pages give general information as to 'tickets,' 'local committees,' 'general instructions,' 'hotel rates,' 'telegraphs,' and 'cash.' The last page is a very convenient schedule, giving the various railways, the points between which they run, the distance in miles, and the rates in English and United States money. The passage which most interests the members of the American association is as follows: "A letter has been received from the representatives of the local committee at Philadelphia, cordially inviting the members of the British association to attend this meeting and take part in its scientific proceedings, and offering to do the utmost in their power to make their visit at once pleasant and profitable."

— From *Nature* we learn that the officers of the British association at the Montreal meeting will be as follows: president, Lord Rayleigh; vice-presidents, the governor-general of Canada, Sir John Alexander Macdonald, Sir Lyon Playfair, Sir Alexander Tilloch Galt, Sir Charles Tupper, Sir Narcisse Dorion, Dr. Chauveau, Principal J. W. Dawson, Professor Edward Frankland, W. H. Hingston, Thomas Sterry Hunt; general treasurer, Prof. A. W. Williamson; general secretaries, Capt. Douglas Galton, A. G. Vernon Harcourt; secretary, Prof. T. G. Bonney; local secretaries, L. E. Dawson, R. A. Ramsay, S. Rivard, S. C. Stevenson, Thomas White; local treasurer, F. Wolferstan Thomas. The sections are the following: — **A**, Mathematical and physical science: president, Sir William Thomson; vice-presidents, Prof. J. B. Cherriman, J. W. L. Glaisher; secretaries, Charles H. Carpmael, Prof. A. Johnson, Prof. O. J. Lodge, D. MacAlister (recorder). **B**, Chemical science: president, Prof. H. E. Roscoe; vice-presidents, Professor Dewar, Prof. B. J. Harrington; secretaries, Prof. P. Phillips Bedson (recorder), H. B. Dixon, T. McFarlane, Prof. W. W. Pike. **C**, Geology: president, W. T. Blanford; vice-presidents, Professor Rupert Jones, A. R. C. Selwyn; secretaries, F. Adams, G. M. Dawson, W. Topley (recorder), W. Whitaker. **D**, Biology: president, Prof. H. N. Moseley; vice-presidents, Dr. W. B. Carpenter, Prof. R. G. Lawson; secretaries, Prof. W. Osler, Howard Saunders (recorder), A. Sedgwick, Prof. R. Ramsay Wright. **E**, Geography: vice-presidents, Col. Rhodes, P. L. Sclater; secretaries, R. Bell, Rev. Abbé Laflamme, E. G. Ravenstein, E. C. Rye (recorder). **F**, Economic science and statistics: president, Sir R. Temple; vice-presidents, J. B. Martin, Prof. J. Clark Murray; secretaries, Prof. H. S. Foxwell, J. S. McLennan, Constantine Molloy (recorder), Prof. J. Watson. **G**, Mechanical science: president, Sir F. J. Bramwell; vice-presidents, Prof. H. T. Bovey, P. G. B. Westmacott; secretaries, A. T. Atchison, J. Kennedy, L. Lesage, H. T. Wood (recorder). **H**, Anthropology: president, Prof. E. B. Tylor; vice-presidents, Prof. W. Boyd Dawkins, Professor Daniel Wilson; secretaries, G. W. Bloxam (recorder), Rev. J. Campbell, Walter Hurst, J. M. P. Lemoine.

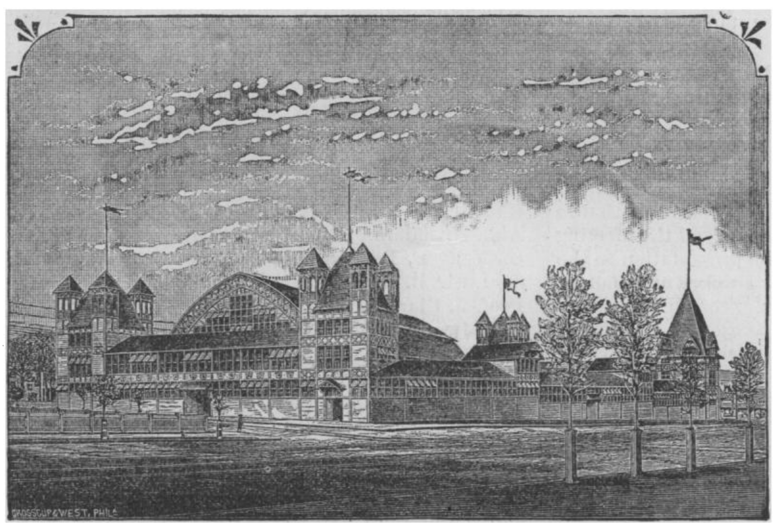
It is expected that the public lectures will be by Mr. Crookes, Dr. Dallinger, and Professor Ball. We are glad to see that Section A is following the good example set by Professor Lankester in biology last year. A circular signed by Sir William Thomson has been issued by the committee of Section A, inviting the co-operation of mathematicians and physicists, and requesting those willing to read papers and take part in the discussions to send their names to the secretaries of Section A, British association, Albemarle Street, London. The following subjects have been selected for special discussion by the committee: on Friday, Aug. 29, The seat of the electromotive forces in the voltaic cell; on Monday, Sept. 1, The connection of sun-spots with terrestrial phenomena.

— At the meeting of the Royal astronomical society, Nov. 9, Prof. S. P. Langley of Allegheny, Penn., Dr. J. A. C. Oudemans of Utrecht, Netherlands, Prof. P. Tacchini of Rome, and Dr. E. Weiss

of Vienna, were elected foreign associates of the society.

— The committee of the Franklin institute, having in charge the organization of the electrical exhibition to be held in Philadelphia, has secured a site for the building on the large vacant lot bounded by Thirty-second and Thirty-third Streets, Lancaster Avenue, and Foster Street, which, by the liberal action of the Pennsylvania railroad company, has been leased to the institute for the purpose of the exhibition for a nominal consideration.

The meeting of the American association for the advancement of science, which will be held this year in Philadelphia, and the expected presence of many representatives of the British association, which will meet this year in Montreal, will attract a numerous and influential scientific gathering in Philadelphia during the time of holding of the exhibition; and, in order that so exceptional an opportunity to promote the interests of science shall not be lost, Congress has been requested to authorize the holding of a national conference of electricians, to convene in Philadelphia at that time. Should Congress make the proper provisions for holding such a conference, the results promise to be of much value.



The accompanying figure is a view of the exhibition building, which is now in process of erection, and which, by the terms of the contract, will be finished by the 15th of June.

The main building will be rectangular, having a length of two hundred and eighty-three feet, and a breadth of a hundred and sixty feet. A tower sixty feet high will be situated at each of the four corners of this building. One central arch of a hundred feet span, and two hundred feet in length, will cover the greater portion of the space occupied by this building; while two smaller ones, having a span of thirty feet, and running parallel to it on either side, will join the towers. The building will have second-story apartments at its ends, with stairways leading up in the towers from the ground floor. The towers themselves will be three stories high. Two long and narrow hall-ways will afford communication between these apartments. The remainder of the ground will be enclosed by a large triangular building one story in height, and joined to the main hall.

The circular of information, with blank forms of application for space, may be obtained by addressing a request therefor to the secretary of the Franklin institute.

— It is proposed to establish a monthly *American meteorological journal*. It will begin with from twenty-four to thirty-two octavo pages, and will be enlarged as rapidly as is justified by the support given it. The first number will probably appear about the 1st of May. It will be published in Detroit by Dr. W. H. Burr. The editing will be in the hands of Prof. M. W. Harrington of Ann Arbor, and he earnestly requests contributions from meteorologists. The publication price is placed at three dollars. All communications of a business character are to be addressed to W. H. Burr & Co., 100 Griswold Street, Detroit, Mich.; all others, to Prof. M. W. Harrington, Ann Arbor, Mich.

— The funeral of the late Dr. J. F. Julius Schmidt, director of the observatory at Athens, was of a public character, and the king and queen of Greece were present at the observatory during the delivery of the oration.

— The German geographical congress will be held in Munich from the 17th to the 19th of April. The principal subjects of discussion will be, the present situation of polar research, the latest proposals for the alteration of the meridian, the glacial period, and the making of school wall-maps. Several well-known travellers and investigators have already promised to speak.

— An international ornithological congress will be held for the first time in Vienna on April 7; and an exhibition of birds, and all that concerns their capture, transport, housing, and feeding, will be open April 4 to 14. The subjects for discussion at the congress will be, (1) a proposal for an international bird-protection act; (2) the origin of the domestic fowl, and the best means of improving the species; and (3) the foundation of stations for ornithological observations all over the inhabitable world. Communications should be addressed to Dr. Gustav von Hayek, 3 Marokkanergasse, Vienna.